# The Technical Basis for Revisions to the Dredged Material Management Program's Bioaccumulative Contaminants of Concern List

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By: Erika Hoffman
US EPA Region 10

# LIST OF ACRONYMS

BAF – Bioaccumulation Factor
BCOC - bioaccumulative contaminant of concern
BT - bioaccumulation trigger levels
BCF - bioconcentration factor
BWG – Bioaccumulation Work Group
CSF – Cancer Slope Factor
DMMP - Dredged Material Management Program
EC-50 – Effective concentration (50% effect)
EPA - Environmental Protection Agency
ERED – Environmental Residue Effects Database
FCV – Final Chronic Value
HSDB – Hazardous Substances Data Bank
IRIS – Integrated Risk Information System
LC-50 – Lethal Concentration (50% mortality)
LOEC - Lowest observed effects concentration
LOED – Lowest observed effects dose
Log Kow – log of the octanol/water partitioning coefficient
MDL – Method detection limit
ML – Maximum level
MRL – Minimum Risk Levels
PAH - polycyclic aromatic hydrocarbon
PCB - polychlorinated biphenyl
PRTV- EPA Provisional Peer Reviewed Toxicity Values
PSDDA - Puget Sound Dredged Disposal Analysis
PSAMP- Puget Sound Ambient Monitoring Program
PSEP – Puget Sound Estuary Program
RCRA – Resource Conservation Recovery Act
RfD – Reference dose
RSET – Regional Sediment Evaluation Team
SMARM – Sediment Management Annual Review Meeting
SEF – Sediment Evaluation Framework
SL – screening level
TEQ – Toxic Equivalency Quotient
TSD – Technical Support Document
TTL – Target Tissue Level
WDOE - Washington State Department of Ecology
WMPT – Waste Management Prioritization Tool
WOE – Weight of Evidence

# 1. PURPOSE

The purpose of this technical appendix is to provide a detailed explanation of how the Dredged Material Management Program (DMMP) revised its Bioaccumulative Contaminants of Concern (BCOC) list. Specifically, this document describes, in detail, the information and approach used to revise the lists. The following key components of this process are presented:

- Developing a list of potential chemicals of concern for bioaccumulation
- Identification of regional monitoring data to characterize the occurrence of potential BCOCs
- Identification of data from the literature to characterize the bioaccumulative potential and toxicity of each potential BCOC
- Developing conceptual criteria defining four different BCOC lists
- Developing a process for placing chemicals on any particular list

Information on the rationale for revising the lists and the programmatic changes in dredged material testing that will occur as a result of the implementation of these lists has already been presented (DMMP 1998 and DMMP, 2003) and is not discussed here.

# 2. BACKGROUND

In 1988, the Puget Sound Dredged Disposal Analysis (PSDDA) program's Evaluation Technical Procedures Appendix established a list of bioaccumulative contaminants of concern (BCOCs) that was a subset of chemicals from the DMMP's contaminant of concern (COC) list. If the sediment concentration of any BCOC exceeded a predetermined bioaccumulation trigger (BT) level established by PSDDA, then there was a "reason to believe" that there could be risk to human and/or ecosystem health due to the accumulation of contaminants in aquatic organisms. When one or more sediment contaminants exceeded BTs, the DMMP agencies required bioaccumulation testing (in addition to toxicity tests) to determine suitability of that sediment for unconfined, open-water disposal.

Up until 2003, the PSDDA (now the DMMP) had a single list of 29 BCOCs (Table 1). The original list of 28 chemicals was developed eighteen years ago based on the best available sediment monitoring and risk assessment information (PSDDA, 1988) and tributyl tin was added to the list in 1989 (PSDDA, 1989). At the 1998 Sediment Management Annual Review Meeting (SMARM), the DMMP presented the rationale and general approach for re-evaluating bioaccumulation testing and interpretation which included revising the list of bioaccumulative contaminants required for analysis (DMMP, 1998 and Hoffman, 1998). The DMMP also convened the Bioaccumulation Work Group (BWG) to participate in the list revision. The BWG was a technical advisory group made up of representatives from regulatory agencies, tribes, research organizations, regulated entities, and environmental consulting firms.

Ultimately, four draft BCOC lists were presented in an Issue Paper at the 2002 SMARM (DMMP, 2002). Based on feedback received in 2002 at the BWG meeting and at the SMARM, revisions were made to the draft lists. The finalized lists were adopted after the 2003 SMARM.

## 3. IDENTIFICATION OF POTENTIAL BCOCs

In the last decade significant advances have been made in the state of our knowledge of bioaccumulation and bioavailability as well as in our ability to detect previously unmeasured contaminants in environmental media. In 1998, EPA staff compiled both general and regional information pertaining to the bioaccumulation of sediment associated contaminants and presented this information in a report entitled "Technical Support Document for DMMP Revisions to the Bioaccumulative Chemicals of Concern List" (Hoffman, 1998). One of the key findings of this report was that several of the chemicals on the then current BCOC list were rarely detected in sediments or tissues while other commonly detected contaminants that would be expected to bioaccumulate did not appear on the list. Considering this, the DMMP saw the need to update its list of bioaccumulative contaminants of concern to more accurately reflect those chemicals that are detected in sediments and in tissues of aquatic organisms in Washington State.

The DMMP wanted the list of potential BCOCs to be inclusive yet limited to what would be realistically expected to occur in this region. In an October 1999 meeting, the Bioaccumulation Work Group discussed what chemicals should be considered for the revised list. BWG members were asked to suggest chemicals based on their research experience (generating and/or reviewing regional sediment/tissue data) as well as their best professional judgement.

Key BWG recommendations included:

- Retain the 65 chemicals proposed by EPA staff in the Technical Support Document (TSD) (Hoffman, 1998). These included the 29 chemicals on the current BCOC list as well as 35 additional chemicals with documented bioaccumulative properties that appear on regional COC lists and have been detected in WA sediment and tissue monitoring programs.

- Retain the subset of pesticides that were dropped from consideration in the 1998 TSD.

- Expand the list of organotins being evaluated (e.g., triphenyltin chloride, methyltin trichloride, tetraethyltin).

- Defer inclusion of individual PCB congeners until completion of a separate process for determining how congener data would be generated and used.

- Include the following compounds that were not discussed in the 1998 TSD:

  Alkylated homologues of PAHs
  Polychlorinated naphthalenes
  Polybrominated terphenyls
  Polybrominated diphenyl ethers (PBDEs)

The final list included the 65 chemicals in the 1998 TSD as well as 75 additional chemicals recommended by the BWG members for a total of 142 chemicals (Table 2). Note that with a few exceptions[1] all of the chemicals identified as "Important Bioaccumulative Compounds" in EPA's Status and Needs report for Bioaccumulation (EPA, 2000a) are found in the DMMP's list of prospective BCOCs.

# 4. APPROACH FOR RANKING BCOCs

## 4.1 Approaches Evaluated

In 1998, the DMMP had already determined that the process for revising the BCOC list would have to consider regional data as well as a chemical's inherent potential to persist and/or biomagnify in aquatic ecosystems. It was expected that there would be a preponderance of evidence to justify both the removal of several volatile contaminants that were on the current BCOC list as well as the addition of other contaminants (e.g., PAHs and divalent metals) that were commonly considered to be bioaccumulative. It was not clear, however, how to address the numerous chemicals about which concern is high but for which regional monitoring data is sparse to nonexistent. The DMMP recognized that it would have to develop a systematic approach to ranking the prospective BCOCs that would consider multiple lines of evidence for determining the bioaccumulative risk posed by a particular contaminant.

Two general approaches that have been used by others to prioritize chemicals relative to bioaccumulation were considered by the DMMP. The first approach, "Scoring", has been used by the EPA's RCRA program in their Waste Management Prioritization Tool (WMPT) (USEPA, 1998). Scoring involves assigning numeric values to criteria associated with various categories of data characterizing bioaccumulative compounds. An example of a category would be "propensity to bioaccumulate", and three associated criteria might be having a bioaccumulation factor (BAF) less than 250, 250 – 1000, and greater than 1000. A chemical with a BAF = 1200 would be considered highly bioaccumulative and would be assigned a value of 3 (on a scale of 1 to 3). In order to derive a ranking for a particular chemical, all the numerical values for different criteria are summed across different categories.

The second approach, known as "Weight of Evidence" (WOE) is similar to Scoring in that it involves grouping information into different categories (e.g., persistence,

[1] Several pesticides included in the EPA (2000) list were not considered because of a lack of documented use in WA State (e.g., dicofol and disulfoton, Beta-BHC, Delta-BHC, nitrofen, oxyfluorfen, and terbufos). Additionally, PCB congeners and carcinogenic PAHs (as a class of compounds) were not considered.

bioaccumulation potential, frequency of detection) each with its own criteria that are indicative of a chemical being of concern for bioaccumulation (e.g., log $K_{ow}$ > 3.5; BAF > 500; detection frequency >50%). The WOE approach differs from Scoring in that no numerical value is assigned to chemicals that meet or don't meet a given criterion. Instead, a chemical is evaluated qualitatively by looking at the number and type of criteria that are met in the different categories. Use of the term "Weight of Evidence" to describe this process is simply meant to convey the fact that multiple lines of evidence are used to determine a chemical's assignment to a list.

Various types of information relevant to prioritizing/ranking a chemical as to the risk posed by its bioaccumulation were considered for use in generating the revised BCOC list. For example, the 1998 TSD summarized the following information (where available) for each of the 65 chemicals examined as prospective BCOCs:

- Actual or potential source loading (from state inventories)
- Appearance on BCOC lists from other programs/regions
- Data from WA State tissue monitoring programs
- Data from WA State sediment monitoring programs
- Information from the scientific literature on the partitioning (log $K_{ow}$), persistence (sediment half-life) and bioaccumulation potential (BCF and BAF) of chemicals and their degradation products
- Ecological effects associated with bioaccumulated chemicals (residue-effects concentrations from the ERED database)

EPA's WMPT (1998) includes a comprehensive compilation of background information on bioaccumulative chemicals, including data on persistence, bioaccumulative potential, and toxicity. The WMPT database proved an invaluable source of information for the BCOC revision effort.

### 4.2 BWG Recommendations

- A majority of the group recommended using the WOE approach for revising the BCOC list, citing its transparency, simplicity, and similarity of the category/criteria development to the Scoring approach.

- Recommended categories of information to be used in the WOE approach were:

    1. Bioaccumulation potential and persistence (e.g., log $K_{ow}$)
    2. Occurrence in sediments (e.g., detection frequency)
    3. Occurrence in tissues (e.g., detection frequency)
    4. Toxicity to humans (e.g., cancer slope factor and reference dose)
    5. Ecological toxicity (e.g., residue-effect concentrations and chronic toxicity)

- The BWG acknowledged that quantification of PCBs based on congener analysis was the likely direction that the DMMP program would be taking. However, given the numerous issues that need resolution prior to transitioning from an Aroclor- to a congener-based approach (e.g., tiered analysis, methods, standards, interpretation), the group decided to defer decisions regarding PCB congeners to a separate process.

For the purposes of list revision, PCBs are retained as a priority BCOC analyzed and quantified as total Aroclors. [2]

- The WOE approach should explicitly recognize the difference between having negative information about the bioaccumulative nature of a chemical and the absence of information.

- Source and loading information was considered but not included in the BWG's recommended categories. For the 1998 TSD, EPA staff investigated a few regional data bases (EPA's Toxic Release Inventory and Washington's Agricultural Use Reporting) but found that the data were limited to specific regulated-use categories and not reflective of quantities that were actually used in this region. Subsequent investigation in 2000-2003 did not reveal any additional queriable data base. The BWG recommended that future efforts to update the BCOC lists include (when possible) a parameter that quantifies a chemical's documented use and/or loading in the region.

- The BWG recommended that a separate investigation be conducted to ensure that standard methods are available and in use by regional labs for all chemicals identified on List 1 (particularly those new to the DMMP program). Methods information and laboratory survey results were collected by D.M.D. Inc in 2001 and are presented in Table 3.

The following sections describe the sources and process by which data were collected for each category.

# 5. BIOACCUMULATION POTENTIAL AND PERSISTENCE

## 5.1 Overview of Available Information

There are many characteristics of nonionic organic chemicals that have been cited as determinants of their potential to persist and bioaccumulate. Among the most commonly cited are susceptibility to degradation or transformation (sediment half-life), octanol-water partitioning coefficient ($K_{ow}$), bioaccumulation factors (BAFs), and bioconcentration factors (BCFs).

Characterization of the potential for a chemical to degrade or transform is highly dependant on the environment in which it is found. It depends not only on the intrinsic properties of a chemical but also on the nature of the surrounding environment (e.g.,

[2] There are major drawbacks to the quantification of PCBs using an Aroclor approach. For one, EPA PCB Aroclor Methods 8081/8082 may underestimate the total concentration of PCBs. When a non-Aroclor manufacturing process (such as the chlor-alkali process) is used; the biphenyl mixtures that result do not conform well to industrial Aroclor patterns. Furthermore, characterization of regional background is compromised since Aroclor detection limits in sediment are often greater than background PCB concentrations. More sensitive congener-based analysis would allow accurate characterization of total PCBs in background sediment samples as well as facilitating more accurate estimates of the risk associated with exposure to low-level PCBs in sediments.

sunlight, microbial community, temperature, redox conditions). Thus, a chemical's sediment half-life can vary in space and time making it unrealistic (and potentially misleading) to assign a single half-life for any given medium (e.g., water, sediment, tissue) (Mackay *et al.*,1995).

It is common practice to use the log $K_{ow}$ to characterize the hydrophobicity, and thereby bioaccumulation potential, of organic compounds (EPA, 2000a). Experimental determination of log $K_{ow}$ values, however, is subject to significant measurement errors. The result is that log $K_{ow}$ values reported in the literature are variable. Numerous models exist for theoretically determining log $K_{ow}$ values as well (e.g., Broto *et al.*, 1984; Vellarkad *et al*., 1989; Ghose and Crippen, 1987). These, too, have a certain degree of variability associated with them.

BAFs and BCFs provide a more direct indicator of a chemical's ability to bioaccumulate, although they can vary widely depending on their basis (estimated or measured), the species used, and the measurement method. A BAF is the ratio of contaminants in tissues to the concentration in the surrounding environment (e.g., via food, sediment and water). A BCF is the ratio of the concentration of a chemical in an organism to its concentration in the surrounding water only. BAF and BCF values may be measured or estimated. BAFs are typically considered to be more accurate predictors of a chemical's potential for bioaccumulation because they account for intake via ingestion of food (USEPA, 1998).

### 5.2 Information Used

The DMMP decided to use log $K_{ow}$ values to characterize the bioaccumulative potential of nonionic organic compounds. This decision was made based on the frequent use of log $K_{ow}$ in other similar exercises and the fact that these values can be obtained for all of the nonionic organic compounds being considered for the BCOC list. Use of sediment half-life data to characterize persistence was dropped from consideration because of the paucity of and variability in the available sediment half-life data. Likewise, BAFs/BCFs were not used to characterize bioaccumulative potential because of the high variability in available values and the fact that empirically-derived BAFs could only be found for 9 of the 142 potential BCOCs considered.

The log $K_{ow}$ values for each of the prospective BCOCs are presented in Table 4. Note that log $K_{ow}$ values are not provided for divalent metals. The DMMP used several sources of information to compiling log $K_{ow}$s. When available, recommended log $K_{ow}$s from Karickhoff and Long (1995) were preferentially used because they were derived by applying best professional judgement to all of the available data (measured and estimated). Other sources of information used to obtain log $K_{ow}$ values include:

- The Hazardous Substances Data Bank (HSDB) compiled by the National Library of Medicine (NLM, 2001)
- EPA's Waste Minimization Prioritization Tool (USEPA, 1998)
- The PhysProp data base maintained by the Syracuse Research Corp (SRC, 2001)

- Canadian Environmental Quality Guidelines for Nonylphenol and its Ethoxylates (Environment Canada, 2000).
- A summary of experimentally derived log $K_{ow}$s for tributyltin in seawater from Meador (2000)
- Handbook of Physical-Chemical Properties and Environmental Fate for Organic Chemicals (Mackay *et* al., 1993)
- Broto's fragmentation method (Broto *et al.*, 1984)
- Viswanadhan's fragmentation method (Vellarkad *et al*., 1989)
- Crippen's fragmentation method (Ghose and Crippen, 1987).

Where a range of values is presented, this represents variability in measurements by a variety of methods and/or the fact that some BCOCs represent a mixture of chemicals and not pure materials.

# 6. OCCURRENCE IN SEDIMENTS

## 6.1 Overview of Available Information

An important indication of the potential bioavailability of a contaminant in the aquatic environment is its presence in sediments. Indeed, one motivation behind revising the BCOC list was the desire to include data on the occurrence of prospective BCOCs from SEDQUAL, an extensive regional sediment database maintained by Washington's Department of Ecology (WDOE). Data contained in SEDQUAL represent marine, estuarine, and freshwater environments and locations ranging from small streams/sloughs to harbors, marinas and navigational channels (WDOE, 2002). A large fraction of the sediment data within SEDQUAL is derived from remediation and navigation dredging programs and therefore provides good representation of the more urbanized areas within Puget Sound. Another advantage to working with a database like SEDQUAL was having the ability to perform customized queries on subsets of data.

## 6.2 Information Used

SEDQUAL was queried in February/March 2002 to extract all freshwater and estuarine/marine sediment chemistry data from Washington State and the Columbia River. These data sets were imported into a MS Access file where they were filtered for the prospective BCOCs, converted to the same units (ppb), and filtered for a consistent measurement basis (dry weight). The detection frequency for each chemical in each data set was determined by dividing the number of samples with detections by the total number of samples that were analyzed for a particular chemical. Additionally, the median sediment concentration was calculated from all samples with detected values for a particular analyte. This sediment occurrence information is presented in Table 5. The results of the query of freshwater data are based on data from a total of 1,355 samples, while the results of the marine/estuarine query are based on data from 25,544 sediment samples.

### 6.3 Additional Issues

While the frequency of detection analysis using data from SEDQUAL is based on a relatively large number of samples, no evaluation was made of how well these samples represent the range of environments found in Puget Sound. Rather than looking only at detection frequency, there should be some consideration of the spatial coverage represented by the database. One way to approach this would be to grid off WA State sediment areas and look at how frequently grid cells were sampled for particular contaminants. This would identify any "critical" geographic areas where certain data were lacking. Likely critical areas might include major urban areas along Puget Sound (e.g. Everett, Seattle, Tacoma) and some of the freshwater sediments in the vicinity of urban areas (e.g. Spokane, Portland/Vancouver).

## 7. OCCURRENCE IN TISSUES

### 7.1 Overview of Available Information

A crucial component in characterizing the bioaccumulative risk posed by a BCOC is the frequency and magnitude of its detection in biota, as this provides a direct indication of a chemical's bioavailability. While the tissue data within SEDQUAL is constrained to marine and estuarine species and are not as extensive as those for sediment, SEDQUAL is nevertheless a significant source of queriable tissue information from this region. The combination of this information with fish tissue data from regional monitoring programs provides enough regional information on occurrence in tissues to aid in prioritizing prospective BCOCs.

### 7.2 Information Used

The SEDQUAL database was queried for all available fish and aquatic invertebrate tissue data in March 2002. All the tissue data in SEDQUAL was from either estuarine or marine environments. In SEDQUAL, a chemical's detection frequency was determined by dividing the number of samples with detections by the total number of samples that were analyzed for that particular chemical. Additionally, when sufficient data were available, the $95^{th}$ percentile of the distribution of detected concentrations was calculated for each data set. If sufficient detected data were not available to calculate a $95^{th}$ percentile concentration, the highest measured tissue concentration was recorded instead. If there were no detected concentrations in the data set for a particular chemical, the $95^{th}$ percentile of the distribution of non-detected concentrations was calculated. Data from the SEDQUAL queries are presented in Table 6.

The only other significant source of regional tissue data (in a queriable format) that was identified was from the Puget Sound Ambient Monitoring Program (PSAMP). The PSAMP database also contains fish tissue data from estuarine and marine environments. The query of PSAMP data was limited to a subset of adult, non-salmonid fish (e.g., bottom fish, rock fish and herring – liver, whole body and/or muscle tissue) caught in

locations that have been designated by PSAMP as urban or near-urban. By limiting the PSAMP query to resident adult fish from contaminated areas, the focus was on the "worst case" tissue data in which there is a greater likelihood of observing elevated tissue concentrations of BCOCs. As was done with the SEDQUAL database, a chemical's detection frequency was determined by dividing the total number of samples with detections by the total number of samples (of all tissue types) that were analyzed for that particular chemical[3]. Summary statistics (e.g., 90$^{th}$ and 95$^{th}$ percentile concentrations) are reported for the tissue type with the highest concentrations and using detected samples only. These queries were run in October 2001. Data from the PSAMP database queries is also presented in Table 6.

### 7.3 Additional Issues

At the time this information was being collected, there were no large and readily/easily queriable sources of freshwater tissue data. This represents a significant data gap and raises the question as to how applicable these lists are to freshwater environments (see Section 12 - Conclusions and Next Steps - for further discussion of this issue).

The marine/estuarine tissue data available for the prospective BCOCs were often limited in terms of its species and spatial coverage. For the purposes of these list revisions, the DMMP developed minimum requirements for determining that sufficient tissue data was available (see Section 10.4). It would, however, be prudent to revisit these requirements to determine whether the existing data provides an adequate basis for including/excluding BCOCs from a given list.

The detection frequencies and 95$^{th}$ percentile concentrations presented in Table 6 were calculated by combining all the tissue data available without making distinctions between different species of aquatic organisms. However, certain classes of compounds (such as carcinogenic PAHs) are metabolized by some receptors (e.g., fish and most crustaceans) but not by others (invertebrates lacking a mixed function oxidase system). Lumping tissue data from both types of receptors together is likely to depress both detection frequencies and percentile concentrations (particularly in a database dominated by fish tissue) resulting in the deprioritization of such compounds. Future updates of these lists should explore the possibility of calculating separate detection frequencies and 95$^{th}$ percentile concentrations for organisms lacking the ability to biotransform prospective BCOCs. Such calculations would be greatly facilitated by increasing the amount of invertebrate tissue data contained within SEDQUAL.

## 8. HUMAN TOXICITY

### 8.1 Overview of Available Information

Sixteen years ago, the DMMP agencies developed a conceptual framework for evaluating bioaccumulation that relied heavily on consideration of potential risks to human health.

[3] All non-detect samples with an MDL greater than 50 ppb were excluded from these summaries. Hence, the total number analyzed was computed as if the samples with MDLs greater than 50 ppb did not exist.

Likewise, in the context of revising the BCOC list, a contaminant's propensity to cause adverse effects to human health following chronic exposure is an important consideration in ranking chemicals. Several lines of information are available with which to evaluate a chemical's potential to cause cancer and non-cancer (e.g., developmental, reproductive) effects to humans.

A common measure of a chemical's carcinogenic risk to humans is the cancer potency value (otherwise known as a cancer slope factor or CSF). The CSFs reported in EPA's Integrated Risk Information System (IRIS) are the ninety-fifth percentile upper confidence limit of the slope of the dose-response curve extrapolated (typically) from high experimental animal doses to low doses typically experienced by people. CSFs are expressed in units of risk per mg/kg-day exposure. Thus, the higher the CSF, the higher the carcinogenic risk associated with a particular chemical. EPA's approach to deriving CSFs produces risk estimates that are protective, but not necessarily predictive of cancer incidence associated with a particular chemical (USEPA, 1994). In addition, EPA has assigned weight of evidence cancer classification (WOE) values to many chemicals. This WOE classification provides information on the quality of the data used to determine the carcinogenic risk of a chemical. Generally, most chemicals with CSFs also have a WOE classification, whereas there are chemicals without sufficient information to derive CSFs but for which a WOE classification exists. There are five WOE classifications within IRIS including: Group A (known human carcinogen); Group B (includes subclassifications B1 and B2, probable human carcinogen and probable human carcinogen - evidence in humans is limited or inadequate but animal evidence is sufficient); Group C (possible human carcinogen – inadequate or no evidence in humans and animal evidence is limited); Group D (unclassifiable due to no human data and ambiguous dose-response trends in animal testing); Group E (evidence of non-carcinogenicity for humans).

Non-cancer effects on humans are typically estimated using a Reference Dose (RfD). The RfD is defined by EPA as "an estimate (with uncertainty perhaps spanning an order of magnitude) of a daily exposure to the human population (including sensitive subgroups) that is likely to be without an appreciable risk of deleterious effects during a lifetime" (USEPA, 1994). RfDs are expressed as milligrams of contaminant per kg consumer body weight per day (mg/kg/day). Thus, the lower a chemical's RfD, the higher its expected non-cancer toxicity. Reference doses are calculated by dividing the dose concentration associated with some toxic effect by an uncertainty factor(s). The more uncertain one is of how well the toxicity data apply to humans, the greater the value of the uncertainty factor(s) used and consequently the lower the reference dose.

### 8.2 Information Used

The DMMP decided to use CSF and WOE classification values to characterize the cancer risk to humans. RfDs were used as a measure of non-cancer risk. The values compiled for the prospective BCOCs are presented in Table 7. Of the potential BCOCs, 28 had CSFs and 54 had RfDs available. Fifty-three chemicals had WOE classifications, of which 24 were classified as A or B.

IRIS is the EPA's official repository of consensus information on chronic human health risk and is a widely-accepted data source due to the extensive review conducted on the risk values contained in the data base (USEPA, 2001a). IRIS was the primary source for most of the CSF, WOE classification and RfD information presented in Table 7. A secondary source of information used was information presented in the WMPT (USEPA, 1998) which includes RfDs and CSFs from the Health Effects Assessment Summary Tables (HEAST) (USEPA, 2004), and various EPA cancer data documents. [4]

# 9. ECOLOGICAL TOXICITY

## 9.1 Overview of Available Information

Because relatively little was known about tissue residues and associated ecological effects associated with sediment contaminants in 1988, the guidelines the agencies developed for triggering and interpreting bioaccumulation tests relied heavily on human health considerations. To ensure ecological health was addressed, the agencies established safety factors in the form of other guidelines for management of open-water disposal sites. The agencies recognized that the bioaccumulation guidance would need to be revisited as more residue-effects data and other indices of ecological risk became available.

The availability of residue-effects databases has grown substantially since the implementation of PSDDA, allowing the ecological effects of bioaccumulation to be considered in revisions to the BCOC list. Several comprehensive databases exist that summarize the results of laboratory studies of the tissue residues associated with adverse effects in aquatic organisms. One such database that is publicly available is the Environmental Residue-Effects Database (ERED) developed by the Army Corps of Engineers and US EPA (USACE, 2001).

Another indicator of the aquatic toxicity associated with chronic exposures to a chemical is EPA's Final Chronic Value (FCV). A FCV is generally intended to represent the highest concentration of a chemical in water that should not cause unacceptable toxicity to aquatic organisms during a long-term exposure. FCVs have been developed by EPA to derive chronic ambient water quality criteria and, more recently, sediment quality criteria. EPA's methodology for developing FCVs specifies minimum data requirements for measured toxicity data and acute-chronic ratios. A FCV is generally the 5th percentile LC- or EC-50 value from a data set involving water-only, long-term exposure to three or more taxa. Alternatively, if these data are not available, a FCV can be estimated by applying an acute-chronic ratio (based on data from at least three different families of fish and invertebrates) to the 5th percentile LC/EC50 from the acute exposure data set for a particular chemical. FCV data are the highest preference values according to the prioritization process outlined in the WMPT (USEPA, 1998).

[4] Note: There has been a change in the toxicity value hierarchy from EPA. The new order is: Tier 1 (IRIS), Tier 2 (PRTV), and Tier 3 (HEAST, draft IRIS assessments, ATSDR's MRLs, and Cal EPA values.

## 9.2 Information Used

Residue-effects data for the prospective BCOCs were compiled from ERED as well as from a URS-Greiner internal database (Shephard, pers. comm.) in February/March 2001. Information compiled from both data bases was limited to data generated for freshwater and marine fish and aquatic invertebrates and published prior to 1997 for the ERED data base and 2001 for the URS data base. The types of adverse effects used in this compilation included effects that are likely have ramifications for a population, including mortality, reduced growth, reproductive effects, abnormal development, and narcosis. Effects classified as biochemical or cellular were excluded from the compilation. For example, biomarkers such as enzymatic effects or markers of exposure such as biliary FACs for which the ecological significance is unknown were not included. The measurement endpoints that were included in the compilation included all those that represent a lowest observed effect concentration or dose (LOEC or LOED). Certain LC- or EC- values were retained as LOED equivalents if they were the lowest of a reported series of LC/EC values and were below 40% effects.

This compilation process resulted in approximately 1140 usable data points for 64 of the prospective BCOCs. These data were sorted by chemical and in order of increasing residue concentration. For each chemical, an actual value from the data set was selected as the LOED screening value. For chemicals with 20 or more data points, the LOED screening value was chosen to be the measured data point that was closest to the $5^{th}$ percentile of the distribution of LOED data for that chemical. The approximate $5^{th}$ percentile value was used so that low concentration outliers would not unduly influence the derivation of the screening value. For chemicals with fewer than 20 data points, the lowest LOED value was used as the screening value. The LOED screening values (in wet weight units), range of data values, and the number of data points for each chemical are shown in Table 8. Supporting documentation with references and data used for the derivation of each LOED screening value can be provided upon request.

FCVs were available for 94 of the 140 potential BCOC chemicals evaluated. Of the 46 remaining chemicals for which no FCVs were available, eight chemicals did have a lowest measured acute toxicity endpoint (LC50 or EC50) available from EPA's AQUIRE database (USEPA, 2001b). These acute toxicity data are presented in Table 8 along with the FCVs.

## 9.3 Additional Issues

It should be noted that a lack of toxicity and/or residue-effects data for a given contaminant is not necessarily an indication that there is no or low bioaccumulative risk associated with it. There are bioaccumulative contaminants of emerging concern for which the toxicity literature is incomplete. Furthermore, parent compounds that are themselves non-toxic can be transformed (biotically and abiotically) into more toxic breakdown products (e.g., debromination of deca-BDE to the more toxic octa- and penta-BDE). Nevertheless, the DMMP decided to use toxicity as a screening component in the list definition process because this information (particularly residue-effects data) is critical for the development and revision of numeric guidelines (e.g., target tissue levels for interpreting bioaccumulation test data) for the List 1 and List 2 BCOCs. In future

updates to these lists, the DMMP and BWG should consider revising the definitions for List 1 and List 2 chemicals such that chemicals lacking human -or eco-toxicity data are not automatically screened out.

# 10. CRITERIA FOR IDENTIFYING BCOCS

## 10.1 Overview of BCOC Criteria

Once information on each chemical had been gathered, the next step was to develop numeric criteria for the potential to bioaccumulate using the five categories of data recommended by the BWG. The following eleven criteria were decided upon using best professional judgement and are conservative thresholds that, taken together, describe a chemical's propensity to bioaccumulate and the potential risks associated with its presence in biological tissues:

- **Bioaccumulation Potential**
  1. Log $K_{ow}$ equal to or greater than 3.5 (for nonionic organic compounds only)

- **Regional Occurrence in Sediments**
  2. Marine/freshwater sediment detection frequency exceeds 10%
  3. Marine/freshwater sediment detection frequency exceeds 50%
  4. Median marine/freshwater concentration exceeds 10x MDL
  5. Median marine/freshwater concentration exceeds 50x MDL

- **Regional Occurrence in Tissues**
  6. Tissue detection frequency exceeds 10%

- **Toxicity to Humans**
  7. Has a cancer slope factor, or IRIS WOE score A or B
  8. Reference dose less than 0.06 mg/kg/day

- **Ecological Toxicity**
  9. Has residue-effect data available in ERED/URS database
  10. $95^{th}$ percentile detected concentration in tissues exceeds the LOED screening value (or $95^{th}$ percentile non-detect concentration exceeds screening value)
  11. Has EPA Final Chronic Value less than 100 ug/L

In the following sections, each of the eleven BCOC criteria and the rationale for their numerical thresholds are described in greater detail.

## 10.2 Bioaccumulation Potential

- Log $K_{ow}$ equal to or greater than 3.5 (for nonionic organic compounds only)

The minimum criteria defining bioaccumulation potential for nonionic organic compounds is a log $K_{ow}$ greater than 3.5. The value of 3.5 was used as a minimum threshold based on observed relationships between the $K_{ow}$ of an unmetabolized chemical and its potential for biomagnification. Specifically, uptake efficiency tends to increase with increasing log $K_{ow}$ for values between 3 and 6 (Thomann, 1989). While there are chemicals with log $K_{ow}$ values less than 3.5 that are known to bioaccumulate, these are typically compounds that do not partition according to equilibrium assumptions (such as organo-metals). As such, organo-metals were not screened using log $K_{ow}$ bioaccumulation criteria.

Several BWG members suggested that an additional criterion should be added to screen out chemicals with log $K_{ow} > 6.5$. Such chemicals are highly hydrophobic and are unlikely to be accumulated in significant quantities by aquatic organisms (EPA, 2000a). The DMMP decided, however, not to apply this additional criterion since log $K_{ow}$ of 6.5 as a lower bound is debatable (for example, the log $K_{ow}$ of several isomers of DDT exceed this value) and its application would only affect approximately ten of the prospective BCOC chemicals. In addition, if a chemical is not found in tissues it will be screened out by the criteria for regional occurrence in tissues.

## 10.3 Regional Occurrence in Sediments

The DMMP developed the following criteria to characterize the magnitude and frequency with which prospective BCOCs occur in sediments:

- Marine/freshwater sediment detection frequency exceeds 10%
- Marine/freshwater sediment detection frequency exceeds 50%
- Median marine/freshwater concentration exceeds 10x MDL (or regional background for trace metals)
- Median marine/freshwater concentration exceeds 50x MDL (or regional background for trace metals)

Evaluation of detection frequencies relative to 10% and 50% are based on a review of the distribution of detection frequencies from the SEDQUAL queries as well as the best professional judgement of the DMMP agency representatives. These values are intended to bound the following conditions: infrequent detection (e.g., detected in less than 10% of the samples for which it is analyzed), occasional detection (e.g., detected in more than 10% but less than 50% of samples for which it is analyzed), and frequent detection (e.g., detected in greater than 50% of the samples for which it is analyzed).

Comparison of median detected sediment concentrations to multipliers of method detection limits (MDL) is intended to characterize the magnitude of occurrence without implying any particular ecological or human health risk associated with a particular concentration. The 10-times and 50-times MDL values were chosen based on best professional judgement of the DMMP agency representatives to aid in prioritization for

the purposes of BCOC list revision. Because concentrations of divalent metals can be naturally elevated in this region, it was decided that comparison to regional background concentrations (rather than MDLs) would be more meaningful for trace metals. Reference concentrations for nearly all trace metals reported in Table 5 are based on the upper bound of the concentration range given in PSEP's Reference Area Performance Standards for Puget Sound (1991). However, reference area data was not available for selenium and antimony whose comparison values are based on MDLs (as indicated in Table 5).

A key recommendation by the BWG was that characterization of the magnitude of detected sediment concentrations should not involve comparisons to effects-based sediment guidelines (such as DMMP's SLs and MLs). Regional sediment guidelines are primarily based on acute bioassay responses and not necessarily associated with bioaccumulation in tissues. In the absence of sediment criteria based on risks associated with bioaccumulation[5], comparison of detected concentrations to a multiplier of the MDL values was viewed as a more objective measure for classifying chemicals based on the magnitude of their occurrence.

### 10.4 Regional Occurrence in Tissues

- Tissue detection frequency exceeds 10%

Overall tissue detection frequency was determined by summing the number of detections in both SEQUAL and PSAMP data sets and dividing that sum by the total number of samples analyzed in both data sets. However, for several of the prospective BCOCs, tissue data was available from only the SEDQUAL data set. Unlike the PSAMP testing program which involves fish tissue samples collected over many years, from several species and from many Puget Sound locations, the data in SEDQUAL is from various unconnected studies which may be very localized in scope and limited in sample size. Out of concern that a relatively small data set could have a disproportionate effect on a chemical's prioritization, the DMMP set a minimum amount of tissue data from SEDQUAL which could be used to evaluate tissue detection frequency. Thus, when the only data available with which to evaluate detection frequency was from SEDQUAL, it would need to be from a minimum of two surveys with data from at least two different taxa and a total number of samples in excess of 30. Prospective BCOC chemicals that did not meet this minimum data requirement would be classified as having "no data available".

### 10.5 Toxicity to Humans

The DMMP used the following criteria describing cancer and non-cancer effects of BCOCs on humans:

- Cancer slope factor, or IRIS WOE score of A or B

[5] A BWG participant has suggested that BSAF-derived risk-based tissue levels such as those proposed in EPA (1997) could be compared to the 10X and 50X MDLs. 10X/50X MDLs that are much greater than the risk based concentrations derived using BSAF approaches might be modified downward.

- Reference dose < 0.06 mg/kg/day

Instead of setting a minimum value for the CSF, the DMMP decided that simply having a slope factor or IRIS score of A or B (known or probably human carcinogen) was sufficient evidence of carcinogenic potential for the purposes of ranking chemicals for a revised BCOC list. For non-cancer effects, the DMMP decided to use the RfD "medium toxicity" threshold value developed by the WMPT (USEPA, 1998). A reference dose of 0.06 mg/kg/day is the 75$^{th}$ percentile value of the distribution of lowest oral and converted inhalation RfDs for all the chemicals evaluated in the WMPT database.

**10.6 Ecological Toxicity**

The DMMP developed the following criteria describing the potential toxicity of BCOCs to aquatic organisms:

- Residue-effect data available in ERED/URS database
- 95$^{th}$ percentile (or maximum) detected concentration in tissues exceeds LOED screening value
  OR
  95$^{th}$ percentile non-detected concentration in tissues is greater than LOED screening value (for chemicals for which there is only non-detect data)
- FCV < 100 ug/L

Only half of the 142 prospective BCOCs have residue-effects data in the most comprehensive national databases (ERED) of this type of information. While important bioaccumulative compounds may be missed by screening based on availability of toxicity information (see issues discussion in Section 9.3), such data are critical for developing interpretive criteria for bioaccumulation tests and therefore form the basis of the first criterion to prioritize chemicals relative to ecological toxicity.

The second criterion compares regional tissue data to a residue-effects screening value. Specifically, the 95$^{th}$ percentile tissue concentration (or the highest detected concentration if insufficient data to calculate a 95$^{th}$ percentile concentration) for a particular chemical as listed in Table 6 is compared to its LOED screening value (if available – see Table 8). The LOED screening value was developed using the data compiled from the ERED and URS databases, and represents a conservative estimate of the lowest dose associated with adverse effects in aquatic species. *The DMMP developed these screening values solely for BCOCs list revision and not for use as regulatory criteria*. These screening values are intended to serve as a measuring stick against which the regional tissue data can be compared. The DMMP determined that this conservative criterion – comparing a high percentile tissue value to a low percentile residue-effects value – is appropriate for the purposes of prioritizing chemicals relative to bioaccumulation testing requirements. That a chemical's 95$^{th}$ percentile detected tissue concentration exceeds the screening LOED should not be interpreted as a quantification of the ecological risk posed by that chemical. The alternative to this criterion applies only to the subset of chemicals that have never been detected in monitoring. A 95$^{th}$ percentile non-detected concentration that is greater than the screening LOED would at least imply that more work is needed to determine

whether method detection limits for a particular chemical are sufficiently low for the purposes of ecological risk assessment.

The BWG recommended use of only detected values to derive 90 and 95$^{th}$ percentile tissue values. Including all of the data (detect and non-detect) resulted in a misleading tissue concentrations particularly due to the high frequency of non-detects in the SEDQUAL database. When non-detected data were included, 95$^{th}$ percentiles were often set by samples with elevated MDLs.

The basis of the FCV criterion is the "high chronic toxicity" threshold used by EPA RCRA's WMPT (USEPA, 1998). The maximum value of 100 ug/L (0.1 mg/L) is based on the chronic aquatic toxicity classification criteria developed by EPA Office of Pollution Prevention and Toxics to evaluate industrial chemicals under the Toxic Substances Control Act.

# 11. BCOC LIST DEFINITIONS

## 11.1 Overview of BCOC Lists

The list of bioaccumulative contaminants of concern as originally conceived in PSDDA (1988) was a single list of contaminants with associated bioaccumulation triggers (BTs) and Target Tissue Levels (TTLs) (See Table 1). Yet in the process of gathering data for the list revision, it became clear that it would be difficult (if not impossible) to establish a single set of pass/fail criteria for determining which chemicals should be on the BCOC list. The DMMP agencies determined that the program would be better served by creation of multiple BCOC lists of differing priority. The agencies proposed the following four conceptual lists which were subsequently approved by the BWG:

> **List 1 Primary BCOCs** – Chemicals on this list meet the DMMP's weight of evidence criteria for defining a bioaccumulative contaminant to be "of concern". Analysis in sediments (and potentially tissues) would be required for all chemicals[6] on this list to determine dredged material suitability.
>
> **List 2 Candidate List of Bioaccumulative Contaminants** - Analysis of these chemicals in sediments and tissues would be decided on an as-needed basis depending on the specifics of the project. List 2 chemicals would also be evaluated by the DMMP as part of disposal site monitoring and other special projects. These chemicals are considered likely to be of concern by the agencies but there is not yet enough information about them to fully meet the List 1 criteria.
>
> **List 3 Potentially Bioaccumulative Contaminants -** Chemicals on this list are potentially bioaccumulative but would not meet the criteria of the other three lists. Typically, List 3 chemicals have been identified in the scientific literature as potentially bioaccumulative but their toxicity to humans and/or ecological

[6] Analysis of Dioxins/Furans is determined on a project-by-project basis.

receptors is unknown or poorly documented. List 3 chemicals will only be considered for analysis in the DMMP program if there is a project-specific reason to believe that they may be present. It is expected, however, that updates to the BCOC database would have the greatest implications for re-classification of List 3 chemicals.

**List 4 Not Currently Considered Bioaccumulative** - Chemicals would be placed on this list because they are not considered bioaccumulative using the criteria developed by the DMMP. That is, they do not significantly partition into the organic fraction (Log Kow < 3.5) or a preponderance of regional data shows that they rarely (if ever) occur in sediments and tissues at levels of toxicological relevance. Note that a chemical's placement on List 4 is based on positive information. Lack of information on a chemical is never justification for being on List 4; such chemicals would be placed in List 3. Classification as a List 4 chemical is not necessarily permanent. Updates to the BCOC database could potentially result in the re-classification of List 4 chemicals as well.

### 11.2 List Definition using Weight-of-Evidence

The next step in the revision process was to define specific guidelines for placing chemicals on each of the BCOC lists using combinations of the eleven BCOC criteria (e.g., a WOE approach). Guided by input from the BWG, the DMMP agencies developed definitions for each of the four lists. For three of the four lists there are two alternate definitions that can be met in order for a chemical to be placed on that particular list. A chemical need only meet one definition in order to be placed on that list. The list definitions were developed to be mutually exclusive such that a chemical will only meet the criteria of one list. The list definitions and the rationale for their selection are presented below.

### A. List 1 Primary Bioaccumulative Contaminants of Concern

Definition 1:

- log $K_{ow}$ > 3.5

AND

- $95^{th}$ percentile of detected tissue concentrations (or max conc.) > Screening LOED

Definition 2:

- log $K_{ow}$ > 3.5

AND

- tissue detection frequency > 10%

AND

- residue-effects LOED available

AND

- known human- and/or ecotoxicity

Chemicals are placed on List 1 because they are hydrophobic and tend to partition into the organic fraction (Log Kow >3.5) and because the higher concentrations that have been detected in regional tissue monitoring exceed values associated with adverse effects in aquatic organisms ($95^{th}$ %ile tissue conc. > $5^{th}$ %ile LOED). Alternatively, List 1 chemicals are hydrophobic, detected in regional tissue monitoring in at least 10 percent of the samples tested, and have residue-effects data available in the scientific literature. Furthermore, they are known to be toxic to human and/or aquatic receptors in that they meet one or more of the following three criteria for human and ecological toxicity:

- Have a Final Chronic Value less than 0.1 mg/L
- Have a cancer slope factor or IRIS WOE score of A or B
- Have a reference dose value less than 0.06 mg/kg/day

Chemicals meeting either the first or second definitions discussed above have a weight-of-evidence indicating that they are of concern for bioaccumulation. Note that both List 1 definitions prioritize tissue data over sediment data. Theoretically, a chemical does not need to be detected in sediments in order to be placed on List 1, although this is rarely the case. Typically, most chemicals detected in tissues are also detected in sediments while the reverse is not always true. It is for this reason that sediment detection is not a component of either List 1 definition. List 1 chemicals are presented in Table 9.

The WOE evaluation placed polychlorodibenzodioxins (PCDD) and polychlorodibenzofurans (PCDF) on Lists 2 and 3, respectively, while 2,3,7,8-TCDD was placed on List 1 based on definition 2. One explanation for this discrepancy is that most of the tissue data queried in this effort did not include analysis for PCDD/PCDF. Furthermore, we did not develop a screening LOED for PCDD and PCDF. Those studies which included analysis for dioxins and furans did so because of site-specific need and typically reported results as toxic equivalents (TEQ) of 2,3,7,8-TCDD. Thus, the DMMP made the decision to put PCDD/F on List 1 based on the screening results for 2,3,7,8-TCDD as well as best professional judgement. Dioxins and furans have a special status

on List 1 in that they are only required for evaluation on an as-needed basis depending on site-specific conditions.

While the lists and the WOE analysis addressed the isomers of DDT (e.g., 2,4' and 4,4' DDD, DDE, and DDT) separately from total DDT, they were lumped together for purposes of list placement. Both 4,4'-DDE and 4,4'-DDT meet List 1 definition 2 and thus total DDT was placed on List 1.

Nearly all divalent trace metals evaluated were placed on List 1 because the 95$^{th}$ percentile tissue concentration exceeded a residue-effects threshold. Since Log Kow values are not available to trace metals, the Log Kow > 3.5 criteria was not applied to them. There has been extensive monitoring of these compounds throughout the Puget Sound region making it likely that some tissues measured would exhibit elevated concentrations. Interpretation of trace metal bioaccumulation data, however is difficult because aquatic species bioaccumulate trace metals to vary degrees and with varying toxicological consequences depending on their mechanisms for uptake, sequestration and metabolism. The DMMP recognizes that a different WOE process will need to be developed in the future for application to trace metals in order to reprioritize them for bioaccumulation assessments.

Based on the summary and survey performed by D.M.D. Inc., standard methods for all List 1 chemicals are available and currently performed by regional laboratories (see Table 3).

**B. List 2 Candidate Bioaccumulative Contaminants**

Definition 1:

- log $K_{ow}$ > 3.5

AND

- no tissue data available[7]

AND

- sediment detection frequency > 50% AND
  median of detected sediment samples exceeds 10x MDL
  (10x reference area concentrations for trace metals)
  OR
  sediment detection frequency > 10% AND
  median of detected samples exceed 50x MDL
  (50x reference area concentrations for trace metals)

AND

[7] Chemicals for which only SEDQUAL tissue data is available must meet the DMMP's minimum criteria for data sufficiency (e.g., data must be from a minimum of two surveys, representing at least two taxa and the total number of samples must be greater than 30).

- known human- and/or ecotoxicity

Definition 2:

- log $K_{ow}$ > 3.5

AND

- no sediment or tissue data available

AND

- known human- and/or ecotoxicity

Chemicals are placed on List 2 because available information indicates that they may be of concern but additional information (primarily from regional tissue and sediment monitoring) is needed in order to make a definitive placement on Lists 1 or 4. According to definition 1, List 2 chemicals are hydrophobic and either frequently detected in sediments at concentrations that are somewhat in excess of detection limits (or reference values or metals) or infrequently detected at concentrations that are well above detection limits/reference values. Furthermore, List 2 chemicals are known to be toxic to human and/or aquatic receptors in that they meet one or more of the following three criteria for human and ecological toxicity:

- Have a Final Chronic Value less than 0.1 mg/L
- Have a cancer slope factor or IRIS WOE score of A or B
- Have a reference dose value less than 0.06 mg/kg/day

Definition 2 addresses the BWG's concern that bioaccumulative chemicals that are not yet including in regional monitoring programs would fall through the cracks in this list definition process. Chemicals that meet definition 2 have not been regionally monitored in tissues or sediments but are hydrophobic and documented to be toxic to human and/or aquatic receptors in the scientific literature. List 2 chemicals are presented in Table 10.

**C. List 3 Potentially Bioaccumulative Contaminants**

Chemicals are placed on List 3 when they do not meet any of the definitions of the other three lists. Typically List 3 chemicals are just beginning to receive national attention due to their potential for persistence and/or being detected in monitoring programs. The critical distinction between List 2 (definition 2) chemicals and those on List 3 is that the former are known to be toxic to human or aquatic receptors while the latter are not. List 3 chemicals will be re-evaluated for list placement when/if additional toxicity and regional occurrence data become available. List 3 chemicals are presented in Table 11.

## D. List 4 Not Currently Considered Bioaccumulative

Definition 1:

- Log Kow < 3.5

Definition 2:

- Log Kow > 3.5

AND

- tissue detection frequency < 10%

AND

- 95$^{th}$ percentile of detected tissue concentrations (or max conc.) < Screening LOED
  OR No Screening LOED available
  OR 95$^{th}$ percentile of non-detected concentrations (when all are NDs) < Screening LOED

AND

- marine sediment detection frequency < 10%[8]

AND

- freshwater sediment detection frequency < 10%[5]

Chemicals are placed on List 4 definition 1 because they are not sufficiently hydrophobic (Log Kow < 3.5) to warrant prioritization under this approach. Alternatively, definition 2 chemicals are sufficiently hydrophobic but regional tissue and sediment data indicate that they are rarely (if ever) detected and when detected are at concentrations that are less then tissue-residue effects levels (when available). Chemicals are always placed on List 4 based on positive information; the lack of information on a chemical is never justification for being on List 4. Thus, chemicals that otherwise satisfy the List 4 definitions but have no regional tissue data, would appear on either List 2 or 3 depending on what is known about their human/ecological toxicity. List 4 is presented in Table 12.

[8] for trace metals which are expected to be detected in nearly all cases, the criterion is "< 10% elevated over reference area concentrations." Reference area concentrations from PSEP (1991)

## 12. CONCLUSIONS AND NEXT STEPS

The BCOC list is a "living" document. The lists will evolve as new information on BCOC chemicals is made available from regional monitoring programs and in the scientific literature. Furthermore, there are many emerging bioaccumulative chemicals of interest about which more information will become available with time. Such chemicals will be periodically added to one of the four lists. The process by which the list database will be maintained and the lists updated is currently being developed.

The DMMP recognizes that the sediment and tissue data used to develop these lists primarily represent marine and estuarine environments of Puget Sound. One would expect a different mixture of contaminants in freshwater environments of this region reflecting, in particular, the greater influence of agricultural activities. For this reason, it is critical to supplement the regional data base used to generate these lists with sediment and (particularly) tissue data from regional monitoring of freshwater environments (e.g., Columbia River and Williamette River). Once this has been accomplished, the Agencies will consider the possibility of creating a separate set of BCOC lists for application to freshwater systems, recognizing that the contaminants of bioaccumulative concern may be very dissimilar between marine/estuarine and freshwater ecosystems.

Some additional issues that should be addressed during future updates of these lists include:

- Incorporating congener-based PCB analysis.
- Re-evaluation of the WOE criteria as applied to divalent metals.
- Updating the prospective BCOC list based on a thorough literature review of emerging bioaccumulative chemicals (e.g., octa- and deca-PBDE).
- Developing (if possible) quantitative criteria reflecting a chemical's documented use and/or loading in the region.
- Evaluating the degree of spatial coverage of freshwater and marine sediment data from SEDQUAL (particularly for critical areas where higher contamination is likely to be observed).
- Re-evaluating the 10X/50X MDL approach to ranking the magnitude of contaminant concentrations in sediment by comparing to BSAF-derived risk-based sediment concentrations.
- Re-evaluating the minimum requirements (spatial and species coverage) for determining tissue data sufficiency for use in placing a chemical on a particular list.
- Developing alternative criteria for placing divalent metals on the lists.
- Calculating taxa-specific detection frequencies and $95^{th}$ percentile concentrations instead of lumping all tissue data together.
- Evaluating the detection limits of the methods used to measure BCOCs in sediments/tissue database relative to risk-based concentrations (where available).
- Revising the definitions for Lists 1 and 2 so that chemicals lacking human- or eco-toxicity data (e.g., CSFs, RfDs and FCVs) are not automatically screened out.

Development of a BCOC list is only the first step toward having scientifically defensible tissue and sediment bioaccumulation triggers (BTs) for use in regional dredging

programs. Recently, an inter-agency Region-wide initiative, encompassing Washington, Oregon, and Idaho, has formed to combine the various regional dredging manuals into a single Sediment Evaluation Framework (SEF) for the Corps Pacific Northwest Region/EPA Region 10. This initiative, known as the Regional Sediment Evaluation Team (RSET), includes a number of subcommittees that are updating portions of the SEF and addressing key issues that arise. One such subcommittee is the Bioaccumulation Subcommittee, which intends to carry forward the work on BCOCs initiated by the DMMP and BWG, described in this report.

The RSET Bioaccumulation Subcommittee has recently completed its draft framework for addressing bioaccumulation in the SEF, and has recommended the following steps be carried out:

- Adoption of this framework for identifying BCOCs
- Potential adoption of these BCOC lists for marine areas
- Collection of additional sediment and tissue data for freshwater areas and development of separate BCOC lists for freshwater areas
- Calculation of tissue BTs for protection of human health, wildlife, and fish/ESA species on a programmatic basis
- Identification of BSAFs for back-calculation of sediment BTs for disposal sites or cleanup sites on a regional or site-specific basis

Methods for carrying out each of these steps are currently being developed and will be presented at an upcoming RSET meeting in 2005.

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**BWG Participants**
Aason, Sandra
Barton, Justine
Bergmann, Karen
Bourcier, Denis
Buchman, Mike
Chartrand, Allan
Davis, Jay
Davoli, Dana
Day, Betsy
Delinger, Dan
Dutch, Maggie
Gardener, Bill
Gries, Tom
Hicks, John
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Hope, Bruce
Hotchkiss, Doug
Keeley, Karen
Kissinger, Lon
Lee, Fu-Shin
Johns, Mike
Kendall, David
Leibl, Matthew
McGroddy, Susan
Malek, John
McCrone, Lawrence
McGinnis, Roger
Meador, Jim
Michelsen, Teresa
Musgrove, Nancy
O'Neill, Sandra
Powell, David
Pinza, Meg
Salazar, Mike
Shephard, Burt
St. Amant, Glen
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**Table 1. Current (DMMP, 2000) List of Chemicals of Concern for Bioaccumulation**

**Metals/Organometals:**
Antimony
Arsenic
Mercury
Nickel
Silver
Tributyltin

**Organic Compounds:**
1,2-Dichlorobenzene
1,3-Dichlorobenzene
1,4-Dichlorobenzene
Aldrin
Bis(2-ethylhexyl)phthalate
Benzo(a)pyrene
Chlordane
Dimethyl phthalate
Di-n-butyl phthalate
Dieldrin
Ethylbenzene
Fluoranthene
Heptachlor and Heptachlor Epoxide
Hexachlorobenzene
Hexachlorobutadiene
Heptachlor
N-Nitrosodiphenylamine
Phenol
Pentachlorophenol
Trichloroethene
Tetrachloroethene
Total DDT + DDE
Total PCBs

**Table 2. Potential BCOCs considered for list revisions**

**PAHs:**

1-methylnaphthalene
1-methylphenanthrene
2,6-Dimethyl naphthalene
2-methylnaphthalene
Acenaphthene
Acenaphthylene
Anthracene
Benzo(a)anthracene
Benzo(a)pyrene
Benzo(e)pyrene
Benzo(ghi)perylene
Benzofluoranthenes
Biphenyl
C1-chrysenes/benzo(a)anthracene
C1-dibenz(a,h)anthracene
C1-fluoranthene/pyrene
C1-fluorenes
C1-naphthalenes
C1-phenanthrene/anthracene
C2-chrysenes/benzo(a)anthracene
C2-dibenz(a,h)anthracene
C2-fluorenes
C2-naphthalenes
C2-phenanthrene/anthracene
C3-chrysenes/benzo(a)anthracene
C3-dibenz(a,h)anthracene
C3-fluorenes
C3-naphthalenes
C3-phenanthrene/anthracene
C4-chrysenes/benzo(a)anthracene
C4-naphthalenes
C4-phenanthrene/anthracene
Chrysene
Dibenzo(a,h)anthracene
Fluoranthene
Fluorene
Indeno(1,2,3-c,d)pyrene
Naphthalene
Perylene
Phenanthrene
Pyrene

**Table 2. Potential BCOCs (cont.)**

**Phthalates:**
Bis(2-ethylhexyl) phthalate
Butyl benzyl phthalate
Dimethyl phthalate
Di-n-butyl phthalate
Di-n-octyl phthalate

**Metals:**
Antimony
Arsenic
Cadmium
Chromium
Chromium VI
Copper
Lead
Mercury
Nickel
Selenium
Silver
Zinc

**Organometallics:**
Tributyltin
Tetraethyltin
Triphenyltin chloride
Methyltin trichloride

**Pesticides, Herbicides and PCBs:**
2,6-dichlorobenzonitrile
Alpha-Benzene Hexachloride
Aldrin
Bromoxynil
Chlordane
Chlorpyrifos
Dacthal
DCPA (dacthal)
Diazinon
Dicamba
Dichlobenil
Dicofol (kelthane)
Dieldrin
Diuron
Endosulfan I/II
Endosulfan sulfate

**Table 2. Potential BCOCs (cont.)**

**Pesticides (cont.)**

Endrin
Ethion
Fenitrothion
G-BHC (Lindane)
Guthion
Heptachlor
Heptachlor epoxide
Kelthane
Methoxychlor
Methyl parathion
Mirex
Oxadiazon
Parathion
Pentachloroanisol
Pronamide
Tetradifon
Total DDT (and individual isomers)
Toxaphene
Trifluralin

**Halogenated Organics:**
1,2,3,4-Tetrachlorobenzene
1,2,3,5-Tetrachlorobenzene
1,2,3-Trichlorobenzene
1,3,5-Trichlorobenzene
1,2,4,5-Tetrachlorobenzene
1,2,4-Trichlorobenzene
1,2-Dichlorobenzene
1,3-Dichlorobenzene
1,4-Dichlorobenzene
2,3,7,8-TCDD
4-bromophenylphenylether
4,4'-Dichlorobenzophenone
Heptachloronaphthalene
Hexachlorobenzene
Hexachloronaphthalene
Octachloronaphthalene
Pentabromodiphenyl ether
Pentachloroanisole
Pentachloronaphthalene

**Halogenated Organics (cont.):**

Polybrominated terphenyls
Polychlorinated alkenes
Polychlorinated biphenyls/Arochlor PCBs
Polychlorinated terphenyls
Polychlorodibenzodioxins (PCDD)
Polychlorodibenzofurans (PCDF)
Tetrachloronaphthalene
Trichloronaphthalene

**Phenols and misc. extractables:**
4-Nonylphenol, branched
Nonylphenol
Dibenzothiophene
Ethoxylated nonylphenol phosphate
N-nitrosodiphenylamine
Pentachlorophenol
Phenol

**Table 3.** see attached Excel spreadsheet

**Table 4.** see attached Excel spreadsheet

**Table 5.** see attached Excel spreadsheet

**Table 6.** see attached Excel spreadsheet

**Table 7.** see attached Excel spreadsheet

**Table 8.** see attached Excel spreadsheet

**Table 9. List 1 Primary Bioaccumulative Contaminants of Concern**

**Definition 1**
Arsenic
Cadmium
Chlordane
Chromium
Copper
Lead
Nickel
Pentachlorophenol
Total Aroclor PCB
Pyrene
Selenium
Silver
Tributyltin[9]
Zinc

**Definition 2**
Dioxins/Furans[10]
Fluoranthene
Hexachlorobenzene
Mercury
Total DDT

[9] TBT analysis is only required on an as-needed basis (see
[10] Dioxins and Furans are only required for analysis on an as-needed basis depending on site-specific conditions.

**Table 10. List 2 Candidate Bioaccumulative Contaminants**

**Definition 1**
Benzo(e)pyrene
Biphenyl
Chlorpyrifos
Diazinon
Endosulfan
Mirex
Perylene

**Definition 2**
1,2,4,5-Tetrachlorobenzene
4-Nonylphenol, branched
Chromium VI
Dacthal
Ethion
Heptachloronaphthalene
Hexachloronaphthalene
Kelthane
Octachloronaphthalene
Oxadiazon
Parathion
pentabromodiphenyl ether
Pentachloronaphthalene
Tetrachloronaphthalene
Tetraethyltin
Trichloronaphthalene
Trifluralin

**Table 11. List 3 Potentially Bioaccumulative Contaminants**

1,2,3,4-Tetrachlorobenzene
1,2,3,5-Tetrachlorobenzene
1,2,3-Trichlorobenzene
1,3,5-Trichlorobenzene
1-methylnaphthalene
1-methylphenanthrene
2,6-Dimethyl naphthalene
2-methylnaphthalene
4,4'-Dichlorobenzophenone
4-bromophenylphenyl ether
Acenaphthene
Acenaphthylene
Aldrin
Alpha-BHC/Alpha-benzene hexachloride
Anthracene
Antimony
Benzo(a)anthracene
Benzo(a)pyrene
Benzo(b)fluoranthene
Benzo(k)fluoranthene
Benzo(g,h,i)perylene
Bis(2-ethylhexyl) phthalate
Butyl benzyl phthalate
C1-chrysenes/benzo(a)anthracene
C1-dibenz(a,h)anthracene
C1-fluoranthene/pyrene
C1-fluorenes
C1-naphthalenes
C1-phenanthrene/anthracene
C2-chrysenes/benzo(a)anthracene
C2-dibenz(a,h)anthracene
C2-fluorenes
C2-naphthalenes
C2-phenanthrene/anthracene
C3-chrysenes/benzo(a)anthracene
C3-dibenz(a,h)anthracene
C3-fluorenes
C3-naphthalenes
C3-phenanthrene/anthracene
C4-chrysenes/benzo(a)anthracene
C4-naphthalenes
C4-phenanthrene/anthracene
Chrysene
Dibenzo(a,h)anthracene

**Table 11. List 3 Potentially Bioaccumulative Contaminants (cont.)**

Dibenzothiophene
Dieldrin
Di-n-butyl phthalate
Di-n-octyl phthalate
Endosulfan sulfate
Ethoxylated nonylphenol phosphate
Fluorene
Gamma-BHC/Gamma-hexachlorocyclohexane
Heptachlor epoxide
Hexachlorobutadiene
Indeno(1,2,3-c,d)pyrene
Methoxychlor
Nonylphenol
Pentachloroanisole
Phenanthrene
Polybrominated terphenyls
Polychlorinated alkenes
Polychlorinated terphenyls
Pronamide
Tetradifon
Toxaphene

**Table 12. List 4 Not Currently Considered Bioaccumulative Contaminants**

**Definition 1**
1,4-Dichlorobenzene
Bromoxynil
Dicamba
Dichlobenil
Dimethyl phthalate
Diuron
Ethylbenzene
Fenitrothion
Guthion
Methyl parathion
Methyltin trichloride
Naphthalene
N-nitroso diphenylamine
Phenol
Tetrachloroethene
Trichloroethene
Triphenyltin chloride

**Definition 2**
1,2,4-Trichlorobenzene
1,2-Dichlorobenzene
1,3-Dichlorobenzene
Endrin
Heptachlor
Hexachloroethane

Table 3. Analytical Method Information for BCOCs

| | | | | Analytical Method | | "Standard" Method Detection Limit ** | | |
|---|---|---|---|---|---|---|---|---|
| Analyte | CAS # | Chemical Symbol or Structure | DMMP Level of Concern (sed-SL) | "Standard" analytical method | Alternate or lab-specific methods for consideration | Sediment (dry wt.) | Tissue (wet wt.) | Comment(s) |
| *Former PSDDA COC's* | | | | | | | | |
| *Metals (mg/kg or ppm)* | | | | | | | | |
| Antimony | 7440-36-0 | Sb | 150 | SW846 M.6020 | | 0.2 | 0.2 | ICP-AES (M.6010) can also reach Sediment SL. GFAA also a viable method. |
| Arsenic | 7440-38-2 | As | 57 | SW846 M.6020 | | 0.5 | 0.5 | ICP-AES (M.6010) can also reach Sediment SL. GFAA also a viable method. |
| Cadmium | 7440-43-9 | Cd | 5.1 | SW846 M.7131 | | 0.04 | 0.04 | ICP-AES (M.6010) can also reach Sediment SL. GFAA also a viable method. |
| Chromium | 7440-47-3 | Cr | - | SW846 M.6020 | | 0.5 | 0.5 | ICP-AES (M.6010) can also reach Sediment SL. |
| Copper | 7440-50-8 | Cu | 390 | SW846 M.6020 | | 0.5 | 0.5 | ICP-AES (M.6010) can also reach Sediment SL. |
| Lead | 7439-92-1 | Pb | 450 | SW846 M.7421 | | 0.1 | 0.1 | ICP-AES (M.6010) can also reach Sediment SL. |
| Mercury | 7439-97-6 | Hg | 0.41 | SW846 M.7471 | | 0.01 | 0.01 | Larger amount digested can also be analyzed by gold foil adsorption and fluorescence detection |
| Nickel | 7440-02-0 | Ni | 140 | SW846 M.6020 | | 0.5 | 0.5 | ICP-AES (M.6010) can also reach Sediment SL. |
| Silver | 7440-22-4 | Ag | 6.1 | SW846 M.7761 | | 0.04 | 0.04 | Potentially low recovery in marine sediment/water due to presence of chloride ion |
| Zinc | 7440-66-6 | Zn | 410 | SW846 M.6010 | | 1.0 | 1.0 | |
| *Organometallics (µg/L or ppb)* | | | | | | | | |
| Tributyltin (interstitial water) | 688-73-3 | $Sn(C_4H_9)_3$ Cl | 0.15 | Krone/Unger | | 0.025 µg/L | | |
| *Organics (µg/kg or ppb)* | | | | | | | | |
| ***total LPAH*** | | | **5200** | | | | | |
| Naphthalene | 91-20-3 |  | 2100 | SW846 M.8270 | | 2 - 20 | 5 - 50 | |
| Acenaphthylene | 208-96-8 |  | 560 | SW846 M.8270 | | 2 - 20 | 5 - 50 | |
| Acenaphthene | 83-32-9 |  | 500 | SW846 M.8270 | | 2 - 20 | 5 - 50 | |
| Fluorene | 86-73-7 |  | 540 | SW846 M.8270 | | 2 - 20 | 5 - 50 | |
| Phenanthrene | 85-01-8 |  | 1500 | SW846 M.8270 | | 2 - 20 | 5 - 50 | |
| Anthracene | 120-12-7 |  | 960 | SW846 M.8270 | | 2 - 20 | 5 - 50 | |
| 2-Methylnaphthalene | 91-57-6 |  | | SW846 M.8270 | | 2 - 20 | 5 - 50 | |
| ***total HPAH*** | | | **12000** | | | | | |
| Fluoranthene | 206-44-0 |  | 1700 | SW846 M.8270 | | 2 - 20 | 5 - 50 | |
| Pyrene | 129-00-0 |  | 2600 | SW846 M.8270 | | 2 - 20 | 5 - 50 | |
| Benzo(a)anthracene | 56-55-3 |  | 1300 | SW846 M.8270 | | 2 - 20 | 5 - 50 | |
| Chrysene | 218-01-9 |  | 1400 | SW846 M.8270 | | 2 - 20 | 5 - 50 | |
| total Benzofluoranthenes (b+k (+j)) | | | 3200 | | | | | |
| Benzo(b)fluoranthene | 205-99-2 |  | | SW846 M.8270 | | 2 - 20 | 5 - 50 | |
| Benzo(k)fluoranthene | 207-08-9 |  | | SW846 M.8270 | | 2 - 20 | 5 - 50 | |
| Benzo(a)pyrene | 50-32-8 |  | 1600 | SW846 M.8270 | | 2 - 20 | 5 - 50 | |
| Indeno(1,2,3-cd)pyrene | 193-39-5 |  | 600 | SW846 M.8270 | | 2 - 20 | 5 - 50 | |
| Dibenz(a,h)anthracene | 53-70-3 |  | 230 | SW846 M.8270 | | 2 - 20 | 5 - 50 | |
| Benzo(g,h,i)perylene | 191-24-2 |  | 670 | SW846 M.8270 | | 2 - 20 | 5 - 50 | |
| ***Chlorinated hydrocarbons*** | | | | | | | | |
| 1,3-Dichlorobenzene | 54-17-1 |  | 170 | SW846 M.8270 | | 2 - 20 | 5 - 50 | |
| 1,4-Dichlorobenzene | 106-46-7 |  | 110 | SW846 M.8270 | | 2 - 20 | 5 - 50 | |
| 1,2-Dichlorobenzene | 95-50-1 |  | 35 | SW846 M.8270 | | 2 - 20 | 5 - 50 | |
| 1,2,4-Trichlorobenzene | 120-82-1 |  | 31 | SW846 M.8270 | SW846 M.8121 or M.8081 (mod.) | 2 -20 / 0.1 - 1.0 | 5 - 50 / 0.25 - 2.5 | |
| Hexachlorobenzene (HCB) | 118-74-1 |  | 22 | SW846 M.8081 | SW846 M.8270 | 0.1 - 1.0 / 2 - 20 | 0.25 - 2.5 / 5 - 50 | |
| Hexachlorobutadiene (HCBD) | 87-68-3 |  | 29 | SW846 M.8270 | SW846 M.8121 or M.8081 (mod.) | 2 -20 / 0.1 - 1.0 | 5 - 50 / 0.25 - 2.5 | |
| Hexachloroethane | 67-72-1 | $C_2Cl_6$ | 1400 | SW846 M.8270 | | 2 - 20 | 5 - 50 | |
| ***Phthalate esters*** | | | | | | | | |
| Dimethyl phthalate | 131-11-3 |  | 1400 | SW846 M.8270 | | 2 - 20 | 5 - 50 | |
| Di-n-butyl phthalate | 84-74-2 |  | 5100 | SW846 M.8270 | | 2 - 20 | 5 - 50 | |
| Butylbenzyl phthalate | 85-68-7 |  | 970 | SW846 M.8270 | | 2 - 20 | 5 - 50 | |
| *bis* (2-Ethylhexyl) phthalate | 117-81-7 |  | 8300 | SW846 M.8270 | | 2 - 20 | 5 - 50 | Some laboratories and/or samplers may exhibit elevated backgrounds. |
| Di-n-octyl phthalate | 117-84-0 |  | 6200 | SW846 M.8270 | | 2 - 20 | 5 - 50 | |
| ***Phenols & miscellaneous extractables*** | | | | | | | | Phenols and other "acid" compounds tend to exhibit lower recoveries due to the chemical class reactivity and |
| | | | | | | | | affinity for adsorption to polar surfaces (i.e. glass). |
| Phenol | 108-95-2 |  | 420 | SW846 M.8270 | | 2 - 20 | 5 - 50 | |
| Pentachlorophenol | 87-86-5 |  | 400 | SW846 M.8270 | SW846 M.8151 or M.8040 (mod.) | 10 - 60 / 1.0 - 10 | 25 - 250 / 1.2 - 12 | |
| N-Nitrosodiphenylamine | 86-30-6 |  | 28 | SW846 M.8270 | | 2 - 20 | 5 - 50 | |
| ***Purgeable or volatile organics*** | | | | | | | | |
| Ethylbenzene | 100-41-4 |  | 10 | SW846 M.8260 | | 0.5 - 3.2 | 1 - 10 | Petroleum constituent and occasionally used as solvent. |
| Tetrachloroethene | 127-18-4 | $C_2Cl_4$ | 57 | SW846 M.8260 | | 0.5 - 3.2 | 1 - 10 | Equivalent to tetrachloroethylene or Perc. |
| Trichloroethene | 79-01-6 | $C_2HCl_3$ | 160 | SW846 M.8260 | | 0.5 - 3.2 | 1 - 10 | Equivalent to trichloroethylene or TCE. |
| ***Chlorinated pesticides & PCBs*** | | | | | | | | |
| total p,p'-DDT, p,p'-DDD & p,p'-DDE | | | 6.9 | | | | | Summation of p,p'-DDT and metabolites. For the DDT's, p,p'- is equiv. to 4,4'- in nomenclature. |
| 4,4'-DDD | 72-54-8 |  | | SW846 M.8081 | | 0.2 - 2.0 | 0.5 - 5.0 | |
| 4,4'-DDE | 72-55-9 |  | | SW846 M.8081 | | 0.2 - 2.0 | 0.5 - 5.0 | |
| 4,4'-DDT | 50-29-3 |  | | SW846 M.8081 | | 0.2 - 2.0 | 0.5 - 5.0 | |
| Aldrin | 309-00-2 |  | 10 | SW846 M.8081 | | 0.1 - 1.0 | 0.25 - 2.5 | |
| Dieldrin | 60-57-1 |  | 10 | SW846 M.8081 | | 0.2 - 2.0 | 0.5 - 5.0 | |
| Heptachlor | 76-44-8 |  | 10 | SW846 M.8081 | | 0.1 - 1.0 | 0.25 - 2.5 | |

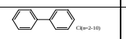
| | | | | Analytical Method | | "Standard" Method Detection Limit ** | | |
|---|---|---|---|---|---|---|---|---|
| Analyte | CAS # | Chemical Symbol or Structure | DMMP Level of Concern (sed-SL) | "Standard" analytical method | Alternate or lab-specific methods for consideration | Sediment (dry wt.) | Tissue (wet wt.) | Comment(s) |
| gamma-BHC / gamma-HCH / Lindane | 58-89-9 |  | 10 | SW846 M.8081 | | 0.1 - 1.0 | 0.25 - 2.5 | |
| Polychlorinated Biphenyls (total PCBs, Aroclors or PCB congeners) | 1336-36-3 |  | 130 | SW846 M.8082 | EPA Office of Water M.1668 | 2.0 - 20 | 5.0 - 50 | Formerly by M. 8081, but now recommended by M. 8082. Can be run as Aroclors or congeners by this method. Also analyzed by EPA M.1668 ( PCB Congeners by High Resolution Mass Spectrometry), which is an adaptation of M.1613 (for analysis of polychlorinated dioxins/furans). Inherent sensitivities are actually greater by GC/ECD, however M.1668 is more selective and minimizes false positive assignments |
| *non-PSDDA COC's* | | | | | | | | |
| *Metals (mg/kg or ppm)* | | | | | | | | |
| Selenium | 7782-49-2 | Se | | SW846 M.7740 | SW846 M.6020 | 0.2 | 0.2 | Best analyzed by GFAA to reduce ICP/MS interferences and provide lower RL |
| Chromium VI | hexavalent ion of 7440-47-3 | Cr (+6) | | SW846 M.7196A or M.7199 | | 0.01 - 0.1 | 0.05 - 0.2 | Requires SW846 M.3060 for sample preparation and extraction. |
| *Organometallics (µg/kg or ppb)* | | | | | | | | |
| Tributyltin chloride | 688-73-3 | $(C_4H_9)_3SnCl$ | | Krone/Unger | | 6.0 | 50 | Either GC/MS or GC/FPD for determinative step; sensitivity slightly greater by GC/FPD, and selectivity greater by GC/MS. |
| Methyltin trichloride | 993-16-8 | $CH_3SnCl_3$ | | Krone/Unger | | 6.0 | 50 | Indirect analysis by Krone and calculation. |
| Tetraethyltin | 597-64-8 | $(C_2H_5)_4Sn$ | | Krone/Unger | | 6.0 | 50 | Modified Krone, not routinely performed. |
| Triphenyltin chloride | 639-58-7 | $(C_6H_5)_3SnCl$ | | Krone/Unger | | 12 | 50 | Modified Krone, not routinely performed. |
| *Organics (µg/kg or ppb)* | | | | | | | | |
| ***Polycyclic aromatic hydrocarbons*** | | | | | | | | |
| Benzo(e)pyrene | 192-97-2 |  | | SW846 M.8270 | | 2 - 20 | 5 - 50 | Not routinely analyzed by most analytical contract labs, but can be on request |
| Biphenyl | 92-52-4 |  | | SW846 M.8270 | | 2 - 20 | 5 - 50 | Not routinely analyzed by most analytical contract labs, but can be on request |
| Perylene | 198-55-0 |  | | SW846 M.8270 | | 2 - 20 | 5 - 50 | Not routinely analyzed by most analytical contract labs, but can be on request |
| ***Alkyl polycyclic aromatic hydrocarbons*** | | | | | | | | |
| C1-Naphthalenes | |  | | SW846 M.8270 | | 2 - 20 | 5 - 50 | Not routinely analyzed by most analytical contract labs, but can be on request. |
| | | | | | | | | Two isomers possible: 1-methylnaphthalene & 2-methylnaphthalene |
| 1-Methylnaphthalene | 90-12-0 |  | | SW846 M.8270 | | 2 - 20 | 5 - 50 | Not routinely analyzed by most analytical contract labs, but can be on request |
| C2-Naphthalenes | |  | | SW846 M.8270 | | 2 - 20 | 5 - 50 | Not routinely analyzed by most analytical contract labs, but can be on request. Twelve isomers possible |
| 2,6-Dimethylnaphthalene | 581-42-0 |  | | SW846 M.8270 | | 2 - 20 | 5 - 50 | Not routinely analyzed by most analytical contract labs, but can be on request |
| C3-Naphthalenes | |  | | SW846 M.8270 | | 2 - 20 | 5 - 50 | Not routinely analyzed by most analytical contract labs, but can be on request. Many isomers possible |
| 1,6,7-Trimethylnaphthalene | 2245-38-7 |  | | SW846 M.8270 | | 2 - 20 | 5 - 50 | Not routinely analyzed by most analytical contract labs, but can be on request |
| 2,3,5-Trimethylnaphthalene | 2245-38-7 |  | | SW846 M.8270 | | 2 - 20 | 5 - 50 | Not routinely analyzed by most analytical contract labs, but can be on request. Same as 1,6,7-trimethylnaphthalene |
| C4-Naphthalenes | |  | | SW846 M.8270 | | 2 - 20 | 5 - 50 | Not routinely analyzed by most analytical contract labs, but can be on request. Many isomers possible |
| C1-Phenanthrenes / Anthracenes | |  | | SW846 M.8270 | | 2 - 20 | 5 - 50 | Not routinely analyzed by most analytical contract labs, but can be on request. Many isomers possible. |
| 1-Methylphenanthrene | 832-69-9 |  | | SW846 M.8270 | | 2 - 20 | 5 - 50 | Not routinely analyzed by most analytical contract labs, but can be on request |
| C2-Phenanthrenes / Anthracenes | |  | | SW846 M.8270 | | 2 - 20 | 5 - 50 | Not routinely analyzed by most analytical contract labs, but can be on request. Many isomers possible. |
| C3-Phenanthrenes / Anthracenes | |  | | SW846 M.8270 | | 2 - 20 | 5 - 50 | Not routinely analyzed by most analytical contract labs, but can be on request. Many isomers possible. |
| C4-Phenanthrenes / Anthracenes | |  | | SW846 M.8270 | | 2 - 20 | 5 - 50 | Not routinely analyzed by most analytical contract labs, but can be on request. Many isomers possible. |
| C1-Fluorenes | |  | | SW846 M.8270 | | 2 - 20 | 5 - 50 | Not routinely analyzed by most analytical contract labs, but can be on request. Five isomers possible |
| C2-Fluorenes | |  | | SW846 M.8270 | | 2 - 20 | 5 - 50 | Not routinely analyzed by most analytical contract labs, but can be on request. Many isomers possible |
| C3-Fluorenes | |  | | SW846 M.8270 | | 2 - 20 | 5 - 50 | Not routinely analyzed by most analytical contract labs, but can be on request. Many isomers possible |
| C1-Fluoranthenes / Pyrenes | |  | | SW846 M.8270 | | 2 - 20 | 5 - 50 | Not routinely analyzed by most analytical contract labs, but can be on request. Many isomers possible |
| C1-Chrysenes / Benzo(a)anthracenes | |  | | SW846 M.8270 | | 2 - 20 | 5 - 50 | Not routinely analyzed by most analytical contract labs, but can be on request. Many isomers possible. |
| C2-Chrysenes / Benzo(a)anthracenes | |  | | SW846 M.8270 | | 2 - 20 | 5 - 50 | Not routinely analyzed by most analytical contract labs, but can be on request. Many isomers possible. |
| C3-Chrysenes / Benzo(a)anthracenes | |  | | SW846 M.8270 | | 2 - 20 | 5 - 50 | Not routinely analyzed by most analytical contract labs, but can be on request. Many isomers possible. |
| C4-Chrysenes / Benzo(a)anthracenes | |  | | SW846 M.8270 | | 2 - 20 | 5 - 50 | Not routinely analyzed by most analytical contract labs, but can be on request. Many isomers possible. |
| C1-Dibenz(--)anthracenes | |  | | SW846 M.8270 | | 2 - 20 | 5 - 50 | Not routinely analyzed by most analytical contract labs, but can be on request. Many isomers possible |
| C2-Dibenz(--)anthracenes | |  | | SW846 M.8270 | | 2 - 20 | 5 - 50 | Not routinely analyzed by most analytical contract labs, but can be on request. Many isomers possible |
| C3-Dibenz(--)anthracenes | |  | | SW846 M.8270 | | 2 - 20 | 5 - 50 | Not routinely analyzed by most analytical contract labs, but can be on request. Many isomers possible |
| ***Miscellaneous extractables*** | | | | | | | | |
| Nonylphenol | 25154-52-3 |  | | SW846 M.8270 | | 2 - 20 | 5 - 50 | Not routinely analyzed by most analytical contract labs, but can be on request |
| 4-Nonylphenol, branched | 84852-15-3 |  | | SW846 M.8270 | | 2 - 20 | 5 - 50 | Not routinely analyzed by most analytical contract labs, but can be on request |
| Ethoxylated nonylphenol phosphate | 51811-79-1 |  | | SW846 M.8270 | SW846 M.8141(mod. | 3 - 30 | 10 - 100 | Not routinely analyzed by most analytical contract labs, but can be on request. |
| Dibenzothiophene | 132-65-0 |  | | SW846 M.8270 | | 2 - 20 | 5 - 50 | Not routinely analyzed by most analytical contract labs, but can be on request |
| ***Halogenated extractable organics*** | | | | | | | | |
| 1,2,3-Trichlorobenzene | 87-61-6 |  | | SW846 M.8270 | SW846 M.8121 or M.8081(mod.) | 2 - 20 / 0.1 - 1.0 | 5 - 50 / 0.25 - 2.5 | Not routinely analyzed by most analytical contract labs, but can be on request. |
| 1,3,5-Trichlorobenzene | 108-70-3 |  | | SW846 M.8270 | SW846 M.8121 or M.8081(mod.) | 2 - 20 / 0.1 - 1.0 | 5 - 50 / 0.25 - 2.5 | Not routinely analyzed by most analytical contract labs, but can be on request. |
| 1,2,3,4-Tetrachlorobenzene | 634-66-2 |  | | SW846 M.8270 | SW846 M.8121 or M.8081(mod.) | 2 - 20 / 0.1 - 1.0 | 5 - 50 / 0.25 - 2.5 | Not routinely analyzed by most analytical contract labs, but can be on request. |
| 1,2,3,5-Tetrachlorobenzene | 634-90-2 |  | | SW846 M.8270 | SW846 M.8121 or M.8081(mod.) | 2 - 20 / 0.1 - 1.0 | 5 - 50 / 0.25 - 2.5 | Not routinely analyzed by most analytical contract labs, but can be on request. |

Table 3. Analytical Method Information for BCOCs

| | | | | Analytical Method | | "Standard" Method Detection Limit ** | | |
|---|---|---|---|---|---|---|---|---|
| Analyte | CAS # | Chemical Symbol or Structure | DMMP Level of Concern (sed-SL) | "Standard" analytical method | Alternate or lab-specific methods for consideration | Sediment (dry wt.) | Tissue (wet wt.) | Comment(s) |
| 1,2,4,5-Tetrachlorobenzene | 95-94-3 |  | | SW846 M.8270 | SW846 M.8121 or M.8081(mod.) | 2 - 20 / 0.1 - 1.0 | 5 - 50 / 0.25 - 2.5 | Not routinely analyzed by most analytical contract labs, but can be on request. |
| Trichloronaphthalenes | 1321-65-9 |  | | SW846 M.8270 | SW846 M.8121 or M.8081(mod.) | 3 - 30 / 0.5 - 5.0 | 5 - 50 / 1.2 - 12 | Halowaxes. Not routinely analyzed by most analytical contract labs, but can be on request. |
| Tetrachloronaphthalenes | 1335-88-2 |  | | SW846 M.8270 | SW846 M.8121 or M.8081(mod.) | 3 - 30 / 0.5 - 5.0 | 5 - 50 / 1.2 - 12 | Halowaxes. Not routinely analyzed by most analytical contract labs, but can be on request. |
| Pentachloronaphthalenes | 1321-64-8 |  | | SW846 M.8270 | SW846 M.8121 or M.8081(mod.) | 3 - 30 / 0.5 - 5.0 | 5 - 50 / 1.2 - 12 | Halowaxes. Not routinely analyzed by most analytical contract labs, but can be on request. |
| Hexachloronaphthalenes | 1335-87-1 |  | | SW846 M.8270 | SW846 M.8121 or M.8081(mod.) | 3 - 30 / 0.5 - 5.0 | 5 - 50 / 1.2 - 12 | Halowaxes. Not routinely analyzed by most analytical contract labs, but can be on request. |
| Heptachloronaphthalenes | 32241-08-0 |  | | SW846 M.8270 | SW846 M.8121 or M.8081(mod.) | 3 - 30 / 0.5 - 5.0 | 5 - 50 / 1.2 - 12 | Halowaxes. Not routinely analyzed by most analytical contract labs, but can be on request. |
| Octachloronaphthalenes | 2234-13-1 |  | | SW846 M.8270 | SW846 M.8121 or M.8081(mod.) | 3 - 30 / 0.5 - 5.0 | 5 - 50 / 1.2 - 12 | Halowaxes. Not routinely analyzed by most analytical contract labs, but can be on request. |
| Polychlorinated alkenes | | | | SW846 M.8270 | SW846 M.8121 or M.8081(mod.) | 5 - 50 / 1.0 - 10 | 10 - 100 / 2.5 - 25 | Not routinely analyzed by most analytical contract labs, but can be on request. |
| Polychlorinated terphenyls | 61788-33-8 |  | | SW846 M.8082 | SW846 M.8270 for confirmation | 4 | 10 | Considered by NOAA to be a "fingerprint" for certain industrial processes like mold release agent for die casting. Also known as Santowaxes or Aroclor 54(00) series. |
| Pentachloroanisole | 1825-21-4 |  | | SW846 M.8270 | SW846 M.8121 or M.8081(mod.) | 2 - 20 / 0.1 - 1.0 | 5 - 50 / 0.25 - 2.5 | Not routinely analyzed by most regional labs. Can also be analyzed by M.8270, if additional calibration standards added. |
| 4,4'-Dichlorobenzophenone | 90-98-2 |  | | SW846 M.8270 | SW846 M.8121 or M.8081(mod.) | 2 - 20 / 0.3 - 3.0 | 5 - 50 / 0.5 - 5.0 | Not routinely analyzed by most analytical contract labs, but can be on request. |
| 2,3,7,8-Tetrachlorodibenzo-*p*-dioxin | 1746-01-6 |  | | EPA Method 1613 | SW846 M.8290 | 0.0001 | 0.0001 | SW846 M.8290 as alternate method; M.1613 has slightly more rigorous QA and reporting requirements. |
| Polychlorodibenzodioxins | |  | | EPA Method 1613 | SW846 M.8290 | 0.0001 - 0.001 | 0.0001 - 0.001 | SW846 M.8290 as alternate method; M.1613 slightly more rigorous QA. 2,3,7,8- isomers show toxicity of concern for estimation of TEQ. Some labs show history of elevated backgrounds for some analytes, especially OCDD |
| Polychlorodibenzofurans | |  | | EPA Method 1613 | SW846 M.8290 | 0.0001 - 0.001 | 0.0001 - 0.001 | SW846 M.8290 as alternate method; M.1613 slightly more rigorous QA. 2,3,7,8- isomers show toxicity of concern for estimation of TEQ. |
| Brominated diphenylethers | |  | | SW846 M.8270 | SW846 M.8121 or M.8081(mod.) | 2 - 20 / 0.3 - 3.0 | 5 - 50 / 0.5 - 5.0 | Not routinely analyzed by most analytical contract labs, but can be on request. |
| Pentabromodiphenyl ether | 32534-81-9 |  | | SW846 M.8270 | SW846 M.8121 or M.8081(mod.) | 2 - 20 / 0.3 - 3.0 | 5 - 50 / 0.5 - 5.0 | Not routinely analyzed by most analytical contract labs, but can be on request. |
| Polybrominated terphenyls | |  | | SW846 M.8082 | SW846 M.8270 for confirmation | 4 | 10 | Not routinely analyzed by most analytical contract labs, but can be on request. |
| ***Chlorinated pesticides*** | | | | | | | | |
| alpha-Benzene hexachloride | 319-84-6 |  | | SW846 M.8081 | | 0.1 - 1.0 | 0.25 - 2.5 | Synonym: alpha-BHC |
| Chlordane | 57-74-9 |  | | SW846 M.8081 | | 0.1 - 1.0 | 0.25 - 2.5 | Technical Chlordane composed of ~70% alpha- & gamma-Chlordanes with the remainder as related chemicals. |
| Dacthal | 1861-32-1 |  | | SW846 M.8081 | SW846 M.8270 for confirmation | 0.1 - 1.0 | 0.25 - 2.5 | Not normally included in M.8081, but can be added on request. |
| Endosulfan | 115-29-7 |  | | SW846 M.8081 | | 0.1 - 1.0 | 0.25 - 2.5 | |
| Endosulfan sulfate | 1031-07-8 |  | | SW846 M.8081 | | 0.2 - 2.0 | 0.5 - 5.0 | |
| Endrin | 72-20-8 |  | | SW846 M.8081 | | 0.2 - 2.0 | 0.5 - 5.0 | |
| Heptachlor epoxide | 1024-57-3 |  | | SW846 M.8081 | | 0.2 - 2.0 | 0.5 - 5.0 | |
| Kelthane | 115-32-2 |  | | SW846 M.8081 | | 1.0 - 10 | 2.5 - 25 | Not routinely analyzed by most analytical contract labs, but can be on request by modified M.8081. Hydroxylated DDT |
| Methoxychlor | 72-43-5 |  | | SW846 M.8081 | | 1.0 - 10 | 2.5 - 25 | |
| Mirex | 2385-85-5 |  | | SW846 M.8081 | | 0.1 - 1.0 | 0.25 - 2.5 | |
| Toxaphene | 8001-35-2 | $C_{10}H_{16-x}Cl_x$ | | SW846 M.8081 | | 5.0 - 50 | 12 - 125 | Chlorinated camphene. |
| Pronamide | 23950-58-5 |  | | SW846 M.8121 or M.8081(mod.) | SW846 M.8270 | 1.0 - 10 | 2.5 - 25 | Not routinely analyzed by most analytical contract labs, but can be on request. M.8270 exhibits higher RL. Synonym: propyzamide. |
| 2,4'-DDD | 53-19-0 |  | | SW846 M.8081 | | 0.2 - 2.0 | 0.5 - 5.0 | Not normally included in M.8081, but can be added on request |
| 2,4'-DDE | 3424-82-6 |  | | SW846 M.8081 | | 0.2 - 2.0 | 0.5 - 5.0 | Not normally included in M.8081, but can be added on request |
| 2,4'-DDT | 789-02-6 |  | | SW846 M.8081 | | 0.2 - 2.0 | 0.5 - 5.0 | Not normally included in M.8081, but can be added on request |
| Dicamba | 1918-00-9 |  | | SW846 M.8151 | | 3.5 | 5.0 | Can also be detected by M.8270 but generally poor response if not derivatized |
| Dichlobenil | 1194-65-6 |  | | SW846 M.8081 | SW846 M.8121 or M.8270 | 1.0 | 2.5 | Not normally included in M.8081, but can be added on request. |
| Diuron | 330-54-1 |  | | SW846 M.8151 | | 3.0 | 5.0 | |
| Oxadiazon | 19666-30-9 |  | | SW846 M.8141 | SW846 M.8121 or M.8081(mod.) | 2.0 - 10 | 5.0 - 20 | Special request analysis, GC/NP analysis - N-mode; or GC/ECD. Can be analyzed by M.8270 with elevated RL. |
| Tetradifon | 116-29-0 |  | | SW846 M.8081 | SW846 M.8121 or M.8270 | 1.0 | 2.5 | Not normally included in M.8081, but can be added on request. |
| ***Other pesticides*** | | | | | | | | |
| Trifluralin | 1582-09-8 |  | | SW846 M.8081 | SW846 M.8141 (N-mode due to presence of N) | 1.0 - 5.0 | 2.0 - 20 | Not routinely analyzed by most analytical contract labs, but can be on request. |
| Bromoxynil | 1689-84-5 |  | | SW846 M.8121 or M.8081(mod.) | SW846 M.8270 | 1.0 / 3.0 - 30 | 2.5 / 5.0 - 50 | Not routinely analyzed by most analytical contract labs, but can be on request. Employment of M.8270 yields higher RL. |
| Ethion | 563-12-2 |  | | SW846 M.8141 | SW846 M.8121 or M.8081(mod.) | 2.5 | 5.0 | Organo-P pesticide. Not routinely analyzed by most regional analytical contract labs. Higher RL by M.8270. |
| Guthion | 86-50-0 |  | | SW846 M.8141 | SW846 M.8121 or M.8081(mod.) | 2.5 | 5.0 | Organo-P pesticide. Not routinely analyzed by most regional analytical contract labs. Higher RL by M.8270. |

Table 3. Analytical Method Information for BCOCs

| | | | | Analytical Method | | "Standard" Method Detection Limit ** | | |
|---|---|---|---|---|---|---|---|---|
| Analyte | CAS # | Chemical Symbol or Structure | DMMP Level of Concern (sed-SL) | "Standard" analytical method | Alternate or lab-specific methods for consideration | Sediment (dry wt.) | Tissue (wet wt.) | Comment(s) |
| Methyl parathion | 298-00-0 |  | | SW846 M.8141 | SW846 M.8121 or M.8081(mod.) | 2.5 | 5.0 | Organo-P pesticide. Best analyzed by GC/FPD or NP for low levels. Can be determined by M.8270, but with higher RL. |
| Parathion | 56-38-2 |  | | SW846 M.8141 | SW846 M.8121 or M.8081(mod.) | 2.5 | 5.0 | Organo-P pesticide. Best analyzed by GC/FPD or NP for low levels. Can be determined by M.8270, but with higher RL. |
| Chlorpyrifos | 2921-88-2 |  | | SW846 M.8141 | SW846 M.8121 or M.8081(mod.) | 2.5 | 5.0 | Not routinely analyzed by most analytical contract labs, but can be on request. |
| Diazinon | 333-41-5 |  | | SW846 M.8141 | | 2.5 | 5.0 | Organo-P pesticide. Best analyzed by GC/FPD or NP for low levels. Can be determined by M.8270, but with higher RL |
| Fenitrothion | 122-14-5 |  | | SW846 M.8141 | | 2.5 | 5.0 | Organo-P pesticide. Best analyzed by GC/FPD or NP for low levels. Can be determined by M.8270, but with higher RL |
| | | | | | | | | |
| Compiled by *D.M.D., Inc.* in association with Striplin Environmental Associates | | | | | | | | |
| | | | | | | | | |
| **Note 1**: SW846 M.XXXX is interpreted as U.S. EPA (Office of Solid Waste) SW846 Method XXXX | | | | | | | | |
| **Note 2**: EPA SW846 Method 6020 is ICP/MS, available at most laboratories or through subcontracting. Advantages over M.6010 (ICP-AES) are generally greater sensitivity and multielement analysis | | | | | | | | |
| **Note 3**: Method 8121 is used to determine chlorinated and other halogenated compounds by GC/ECD. Not commonly run by many regional analytical contract labs | | | | | | | | |
| In general, the screening-type organics analyses methods, such as M.8081, 8121, 8141 and 8151, offer enhanced sensitivities; however, disadvantages include reduced selectivities and greater chances of false positive identification | | | | | | | | |
| M.8270, while exhibiting generally reduced sensitivity or elevated RL compared to the "screening" methods, offers extremely high selectivity which reduces chances of false positive assignments | | | | | | | | |
| M.8270, as the EPA method is written, is a full-scan method, which yields the greatest selectivity. Improvements in sensitivity (generally by a factor of 10) can be attained if run in an SIM mode, which yields less selectivit | | | | | | | | |
| M.8270 should be run, whenever possible, in a full-scan mode to yield the greatest amount of information regarding potential interferences, the presence of TICs, and to achieve greatest selectivity | | | | | | | | |
| M.8270 run in a full scan mode may not always be possible if sensitivity issues are paramount and reduced RLs are required | | | | | | | | |
| **Note 4**: In general, all analytical results should be reported with % moisture, TOC and % lipid contents, as appropriate to the sample matrix | | | | | | | | |
| | | | | | | | | |
| **Big Note**: While recommended or alternate methods are identified above for the analysis of the chemicals of concern, it is strongly suggested that a "performance-based" approach be employed by analytical contract labs in order to encourage innovation and for achievement of pre-established DQO | | | | | | | | |
| Careful identification of DQOs for the chemicals of concern by technical program managers and providing the DQOs to the project laboratory is critical to achieve project/program goals. Failure to do so can be expected to result in failure of the monitoring effor | | | | | | | | |
| It is strongly encouraged that DQOs be identified that can also be indicators of analytical performance for the analyses of difficult chemicals in problem matrices. Remember - not all samples behave the same; all environmental samples should be considered different and atypica | | | | | | | | |
| Technical project managers and data users are strongly encouaged to work with their project labs during the planning and monitoring phases in order to ensure success in achievement of monitoring goals | | | | | | | | |
| | | | | | | | | |
| ** Principal or initial reported "method detection limit" is a verifiable quantitation level or range attained within a linear calibration with authentic chemical standards. This level/value should have associated QC with A10 representing ar | | | | | | | | |
| estimated or extrapolated "limit". A second listed limit or range is associated with the alternate method (if identified). The reported limits and ranges should be considered approximate and are generally attained by reputable and competent analytical contract laboratorie | | | | | | | | |
| Lower limits than those presented here can be attained, however, extra effort and special techniques will be necessary. Improvements in sensitivities by factors of 10x or more are also achievable and have been demonstrated, however special sampling and handling may also be required to lim | | | | | | | | |
| interference from inadvertent or background artifactual contamination. | | | | | | | | |
| | | | | | | | | |
| SAPA = Sampling Analysis Plan Appendix - maximum RLs set at 1/3 the SL to esure that exceedences are real | | | | | | | | |

| Chemical | CAS | Log kow (1) | Reference |
|---|---|---|---|
| 1,2,3,4-Tetrachlorobenzene | 634-66-2 | 4.61 | |
| 1,2,3,5-Tetrachlorobenzene | 634-90-2 | 4.67 | |
| 1,2,3-Trichlorobenzene | 87-61-6 | 4.10 | |
| 1,2,4,5-Tetrachlorobenzene | 95-94-3 | 4.64 | |
| 1,2,4-Trichlorobenzene | 120-82-1 | 4.01 | |
| 1,2-Dichlorobenzene | 95-50-1 | 3.43 | |
| 1,3,5-Trichlorobenzene | 108-70-3 | 4.17 | |
| 1,3-Dichlorobenzene | 54-17-1 | 3.53 | |
| 1,4-Dichlorobenzene | 106-46-7 | 3.42 | |
| 1-methylnaphthalene | 90-12-0 | 3.9 - 4.0 | DMD |
| 1-methylphenanthrene | 832-69-9 | 5.10 | DMD |
| 2,3,7,8-Tetrachlorodibenzo-p-dioxin | 1746-01-6 | 6.53 | |
| 2,4'-DDD | 53-19-0 | 5.87 | SRC |
| 2,4'-DDE | 3424-82-6 | 6.00 | SRC |
| 2,4'-DDT | 789-02-6 | 6.79 | SRC |
| 2,6-Dimethyl naphthalene | 581-42-0 | 4.3 - 4.4 | DMD |
| 2-methylnaphthalene | 91-57-6 | 3.86 | |
| 4,4'-DDD | 72-54-8 | 6.10 | |
| 4,4'-DDE | 72-55-9 | 6.76 | |
| 4,4'-DDT | 50-29-3 | 6.53 | |
| 4,4'-Dichlorobenzophenone | 90-98-2 | 4.44 | SRC |
| 4-bromophenylphenylether | 101-55-3 | 4.94 | WMPT |
| 4-Nonylphenol, branched | 84852-15-3 | 5.92 | WMPT |
| Acenaphthene | 83-32-9 | 3.92 | |
| Acenaphthylene | 208-96-8 | 3.94 | WMPT |
| Aldrin | 309-00-2 | 6.50 | |
| Alpha-Benzene Hexachloride | 319-84-6 | 3.80 | |
| Anthracene | 120-12-7 | 4.55 | |
| Antimony | 7440-36-0 | N/A | |
| Arsenic | 7440-38-2 | N/A | |
| Benzo(a)anthracene | 56-55-3 | 5.70 | |
| Benzo(a)pyrene | 50-32-8 | 6.11 | |
| Benzo(b)fluoranthene | 205-99-2 | 6.20 | |
| Benzo(e)pyrene | 192-97-2 | 6.44 | WMPT |
| Benzo(g,h,i)perylene | 191-24-2 | 6.70 | |
| Benzo(k)fluoranthene | 207-08-9 | 6.20 | |
| Biphenyl | 92-52-4 | 4.01 | |
| Bis(2-ethylhexyl) phthalate | 117-81-7 | 7.30 | |
| Bromoxynil | 1689-84-5 | 3.39 | WMPT |
| Butyl benzyl phthalate | 85-68-7 | 4.84 | |
| C1-Chrysenes/Benzo(a)anthracene | # | 5.5 - 5.6 | DMD |
| C1-dibenz(a,h)anthracene | # | 6.5 - 6.8 | DMD |
| C1-fluoranthene/pyrene | # | 4.8 - 5.0 | DMD |
| C1-fluorenes | # | 4.6 - 5.0 | DMD |
| C1-Naphthalenes | # | 3.7 - 4.1 | DMD |
| C1-phenanthrene/anthracene | # | 5.1 - 5.7 | DMD |
| C2-Chrysenes/Benzo(a)anthracene | # | 5.8 - 7.0 | DMD |
| C2-dibenz(a,h)anthracene | # | 7.0 - 7.2 | DMD |
| C2-fluorenes | # | 4.2 - 4.7 | DMD |
| C2-Naphthalenes | # | 4.2 - 4.6 | DMD |
| C2-phenanthrene/anthracene | # | 5.3 - 5.7 | DMD |
| C3-Chrysenes/Benzo(a)anthracene | # | 6.2 - 6.6 | DMD |
| C3-dibenz(a,h)anthracene | # | 7.2 - 7.6 | DMD |

| Chemical | CAS | Log kow (1) | Reference |
|---|---|---|---|
| C3-fluorenes | # | 4.6 - 5.2 | DMD |
| C3-Naphthalenes | # | 4.8 - 4.9 | DMD |
| C3-phenanthrene/anthracene | # | 5.3 - 5.5 | DMD |
| C4-Chrysenes/Benzo(a)anthracene | # | 6.6 - 7.0 | DMD |
| C4-Naphthalenes | # | 4.7 - 4.9 | DMD |
| C4-phenanthrene/anthracene | # | 5.7 - 5.9 | DMD |
| Cadmium | 7440-43-9 | N/A | |
| Chlordane | 57-74-9 | 6.32 | |
| Chlorpyrifos | 2921-88-2 | 5.26 | |
| Chromium | 7440-47-3 | N/A | |
| Chromium IV | # | N/A | |
| Chrysene | 218-01-9 | 5.70 | |
| Copper | 7440-50-8 | N/A | |
| Dacthal | 1861-32-1 | 4.40 | |
| Diazinon | 333-41-5 | 3.81 | |
| Dibenz(a,h)anthracene | 53-70-3 | 6.69 | |
| Dibenzothiophene | 132-65-0 | 4.38 | SRC |
| Dicamba | 1918-00-9 | 2.21 | |
| Dichlobanil | 1194-65-6 | 2.74 | HSDB |
| Dieldrin | 60-57-1 | 5.37 | |
| Dimethyl phthalate | 131-11-3 | 1.57 | |
| Di-n-butyl phthalate | 84-74-2 | 4.61 | |
| Di-n-octyl phthalate | 117-84-0 | 8.06 | |
| Diuron | 330-54-1 | 2.80 | |
| Endosulfan | 115-29-7 | 4.10 | |
| Endosulfan sulfate | 1031-07-8 | 3.66 | |
| Endrin | 72-20-8 | 5.06 | |
| Ethion | 563-12-2 | 5.07 | |
| Ethoxylated nonylphenol phosphate | 51811-79-1 | 4.1 - 4.4 | CAN |
| Ethylbenzene | 100-41-4 | 3.14 | |
| Fenitrothion | 122-14-5 | 3.30 | WMPT |
| Fluoranthene | 206-44-0 | 5.12 | |
| Fluorene | 86-73-7 | 4.21 | |
| gamma-BHC /gamma-Hexachlorocyclohexane | 58-89-9 | 3.73 | |
| Guthion | 86-50-0 | 2.75 | |
| Heptachlor | 76-44-8 | 6.26 | |
| Heptachlor epoxide | 1024-57-3 | 5.00 | |
| Heptachloronaphthalene | 32241-08-0 | 7.68 | WMPT |
| Hexachlorobenzene | 118-74-1 | 5.89 | |
| Hexachlorobutadiene | 87-68-3 | 4.81 | |
| Hexachloroethane | 67-72-1 | 4.00 | |
| Hexachloronaphthalene | 1335-87-1 | 7.04 | WMPT |
| Indeno(1,2,3-c,d)pyrene | 193-39-5 | 6.65 | |
| Kelthane | 115-32-2 | 6.06 | |
| Lead | 7439-92-1 | N/A | |
| Mercury | 7439-97-6 | N/A | |
| Methoxychlor | 72-43-5 | 5.08 | |
| Methyl parathion | 298-00-0 | 2.90 | |
| Methyltin trichloride | 993-16-8 | -1.29 | WMPT |
| Mirex | 2385-85-5 | 6.89 | |
| Naphthalene | 91-20-3 | 3.36 | |
| Nickel | 7440-02-0 | N/A | |
| N-nitroso diphenylamine | 86-30-6 | 3.16 | |

| Chemical | CAS | Log kow (1) | Reference |
|---|---|---|---|
| Nonylphenol | 25154-52-3 | 6.00 | WMPT |
| Octachloronaphthalene | 2234-13-1 | 8.24 | WMPT |
| Oxadiazon | 19666-30-9 | 4.80 | SRC |
| Parathion | 56-38-2 | 3.83 | |
| pentabromodiphenyl ether | 32534-81-9 | 7.4 - 12.8 | DMD |
| Pentachloroanisole | 1825-21-4 | 5.45 | HSDB |
| Pentachloronaphthalene | 1321-64-8 | 6.88 | WMPT |
| Pentachlorophenol | 87-86-5 | 5.09 | |
| Perylene | 198-55-0 | 6.25 | WMPT |
| Phenanthrene | 85-01-8 | 4.55 | |
| Phenol | 108-95-2 | 1.48 | |
| Polybrominated terphenyls | # | 6.5 - 17.2 | DMD |
| Polychlorinated alkenes | # | 4.5 - 15 | DMD |
| Polychlorinated Biphenyls | 1336-36-3 | 3.6 - 11 | DMD |
| Polychlorinated Terphenyls | 61788-33-8 | 6.0 - 13.4 | DMD |
| Polychlorodibenzodioxins | # | 5.5 - 13.1 | DMD |
| Polychlorodibenzofurans | # | 5.8 - 13.9 | DMD |
| Pronamide | 23950-58-5 | 3.51 | |
| Pyrene | 129-00-0 | 5.11 | |
| Selenium | 7782-49-2 | N/A | |
| Silver | 7440-22-4 | N/A | |
| Tetrachloroethene | 127-18-4 | 2.67 | |
| Tetrachloronaphthalene | 1335-88-2 | 5.86 | WMPT |
| Tetradifon | 116-29-0 | 4.72 | HSDB |
| Tetraethyltin | 597-64-8 | 5.44 | WMPT |
| Total benzofluoranthenes (b+k (+j)) | # | N/A | |
| Total pp,-DDT,-DDD,-DDE | # | N/A | |
| Toxaphene | 8001-35-2 | 5.50 | |
| Tributyltin | 688-73-3 | 3.7 - 4.4 | Meador |
| Trichloroethene | 79-01-6 | 2.71 | |
| Trichloronaphthalene | 1321-65-9 | 5.10 | WMPT |
| Trifluralin | 1582-09-8 | 5.34 | |
| Triphenyltin chloride | 639-58-7 | 2.83 | |
| Zinc | 7440-66-6 | N/A | |
| | | | |
| N/A = not applicable; | | | |
| # = no CAS number available | | | |
| (1) Log Kow values from Karickhoff and Long (1995) except as noted. | | | |
| HSDB = from the Hazardous Substances Data Bank compiled by the National Library of Medicine (NLM, 2001) | | | |
| WMPT = from EPA's Waste Minimization Prioritization Tool (USEPA,1998) | | | |
| SRC = from PhysProp data base maintained by the Syracuse Research Corp (SRC,2001) | | | |
| CAN = from Canadian Environmental Quality Guidelines for Nonylphenol and its Ethoxylates (Environment Canada, 2000). | | | |
| Meador = from Meador (2000) | | | |
| DMD = as compiled by D.M.D. Inc. from the following sources: | | | |
| Mackay *et al.,* 1993; Broto *et al.,* 1984; Vellarkad *et al.,* 1989; Ghose and Crippen, 1987. | | | |
| A range of values represents the ranges associated with experimental measurement by a variety of methods | | | |
| and/or the fact that some entries represent a mixture of chemicals and not pure materials. | | | |

| | | SEDQUAL Freshwater (1) | | | | SEDQUAL Marine (2) | | Comparison values (3) | | |
|---|---|---|---|---|---|---|---|---|---|---|
| Chemical | CAS | Number of Samples | % Detected | Median of detected values ppb dw | Number of Samples | % Detected | Median of detected values ppb dw | MDL or Reference Value | 10X | 50X |
| 1,2,3,4-Tetrachlorobenzene | 634-66-2 | | | | | | | 2 - 20 / 0.1 - 1.0 | 20 - 200 / 1.0 - 10 | 100 - 1000 / 5 - 50 |
| 1,2,3,5-Tetrachlorobenzene | 634-90-2 | | | | | | | 2 - 20 / 0.1 - 1.0 | 20 - 200 / 1.0 - 10 | 100 - 1000 / 5.0 - 50 |
| 1,2,3-Trichlorobenzene | 87-61-6 | 24 | 0.0 | ND | 85 | 0.0 | ND | 2 - 20 / 0.1 - 1.0 | 20 - 200 / 1.0 - 10 | 100 - 1000 / 5.0 - 50 |
| 1,2,4,5-Tetrachlorobenzene | 95-94-3 | | | | | | | 2 - 20 / 0.1 - 1.0 | 20 - 200 / 1.0 - 10 | 100 - 1000 / 5.0 - 50 |
| 1,2,4-Trichlorobenzene | 120-82-1 | 188 | 0.5 | 150 | 4782 | 3.9 | 14 | 2 -20 / 0.1 - 1.0 | 20 - 200 / 1.0 - 10 | 100 - 1000 / 5.0 - 50 |
| 1,2-Dichlorobenzene | 95-50-1 | 173 | 1.7 | 3 | 4923 | 5.7 | 5 | 2 - 20 | 20 - 200 | 100 - 1000 |
| 1,3,5-Trichlorobenzene | 108-70-3 | | | | | | | 2 - 20 / 0.1 - 1.0 | 20 - 200 / 1.0 - 10 | 100 - 1000 / 5.0 - 50 |
| 1,3-Dichlorobenzene | 541-73-1 | 200 | 0.5 | 601 | 4926 | 4.8 | 5 | 2 - 20 | 20 - 200 | 100 - 1000 |
| 1,4-Dichlorobenzene | 106-46-7 | 196 | 7.1 | 16 | 5076 | 11.5 | 17 | 2 - 20 | 20 - 200 | 100 - 1000 |
| 1-methylnaphthalene | 90-12-0 | 28 | 67.9 | 300 | 3572 | 11.4 | 21 | 2 - 20 | 20 - 200 | 100 - 1000 |
| 1-methylphenanthrene | 832-69-9 | | | | 3126 | 16.0 | 38 | 2 - 20 | 20 - 200 | 100 - 1000 |
| 2,3,7,8-Tetrachlorodibenzo-p-dioxin | 1746-01-6 | 29 | 37.9 | 0.0012 | 2653 | 9.2 | 32 | 0.0001 | 0.001 | 0.005 |
| 2,4'-DDD | 53-19-0 | 15 | 0.0 | ND | 2723 | 8.9 | 24 | 0.2 - 2.0 | 2 - 20 | 10 - 100 |
| 2,4'-DDE | 3424-82-6 | 15 | 0.0 | ND | 2658 | 8.5 | 26 | 0.2 - 2.0 | 2 - 20 | 10 - 100 |
| 2,4'-DDT | 789-02-6 | 15 | 0.0 | ND | 2571 | 7.4 | 71 | 0.2 - 2.0 | 2 - 20 | 10 - 100 |
| 2,6-Dimethyl naphthalene | 581-42-0 | | | | 2345 | 10.7 | 60 | 2 - 20 | 20 - 200 | 100 - 1000 |
| 2-methylnaphthalene | 91-57-6 | 266 | 51.9 | 173 | 5414 | 40.0 | 46 | 2 - 20 | 20 - 200 | 100 - 1000 |
| 4,4'-DDD | 72-54-8 | 151 | 7.3 | 1 | 4090 | 18.0 | 9 | 0.2 - 2.0 | 2 - 20 | 10 - 100 |
| 4,4'-DDE | 72-55-9 | 151 | 13.9 | 9 | 4107 | 15.2 | 9 | 0.2 - 2.0 | 2 - 20 | 10 - 100 |
| 4,4'-DDT | 50-29-3 | 151 | 2.0 | 12 | 4300 | 12.9 | 26 | 0.2 - 2.0 | 2 - 20 | 10 - 100 |
| 4,4'-Dichlorobenzophenone | 90-98-2 | | | | | | | 2 - 20 / 0.3 - 3.0 | 20 - 200 / 3.0 - 30 | 100 - 1000 / 15 - 150 |
| 4-bromophenylphenylether | 101-55-3 | | | | | | | 2 - 20 / 0.3 - 3.0 | 20 - 200 / 3.0 - 30 | 100 - 1000 / 15 - 150 |
| 4-Nonylphenol, branched | 84852-15-3 | | | | | | | 2 - 20 | 20 - 200 | 100 - 1000 |
| Acenaphthene | 83-32-9 | 270 | 55.2 | 283 | 6147 | 43.8 | 62 | 2 - 20 | 20 - 200 | 100 - 1000 |
| Acenaphthylene | 208-96-8 | 274 | 43.8 | 180 | 5767 | 36.7 | 41 | 2 - 20 | 20 - 200 | 100 - 1000 |
| Aldrin | 309-00-2 | 156 | 10.3 | 21 | 5577 | 26.9 | 230 | 0.1 - 1.0 | 1 - 10 | 5 - 50 |
| Alpha-Benzene Hexachloride | 319-84-6 | 146 | 11.0 | 25 | | | | 0.1 - 1.0 | 1 - 10 | 5 - 50 |
| Anthracene | 120-12-7 | 273 | 59.7 | 484 | 6675 | 59.1 | 140 | 2 - 20 | 20 - 200 | 100 - 1000 |
| Antimony | 7440-36-0 | 148 | 10.8 | 2800 | 6697 | 47.9 | 1330 | 200 (MDL) | 2000 | 10000 |
| Arsenic | 7440-38-2 | 368 | 97.0 | 7600 | 8167 | 73.0 | 8000 | 22000 | 220000 | 1100000 |
| Benzo(a)anthracene | 56-55-3 | 256 | 72.3 | 1100 | 6958 | 69.3 | 210 | 2 - 20 | 20 - 200 | 100 - 1000 |
| Benzo(a)pyrene | 50-32-8 | 271 | 67.2 | 1500 | 7164 | 70.4 | 220 | 2 - 20 | 20 - 200 | 100 - 1000 |
| Benzo(b)fluoranthene | 205-99-2 | 92 | 84.8 | 3000 | 6571 | 70.7 | 340 | 2 - 20 | 20 - 200 | 100 - 1000 |
| Benzo(e)pyrene | 192-97-2 | | | | 5554 | 71.2 | 270 | 2 - 20 | 20 - 200 | 100 - 1000 |
| Benzo(g,h,i)perylene | 191-24-2 | 265 | 62.3 | 1400 | 6563 | 70.1 | 310 | 2 - 20 | 20 - 200 | 100 - 1000 |
| Benzo(k)fluoranthene | 207-08-9 | 94 | 75.5 | 1300 | 5723 | 72.7 | 430 | 2 - 20 | 20 - 200 | 100 - 1000 |
| Biphenyl | 92-52-4 | | | | 4902 | 74.0 | 450 | 2 - 20 | 20 - 200 | 100 - 1000 |
| Bis(2-ethylhexyl) phthalate | 117-81-7 | 226 | 62.8 | 1300 | 6548 | 72.1 | 380 | 2 - 20 | 20 - 200 | 100 - 1000 |
| Bromoxynil | 1689-84-5 | | | | | | | 1.0 / 3.0 - 30 | 10 / 30 - 300 | 50 / 150 - 1500 |
| Butyl benzyl phthalate | 85-68-7 | 214 | 17.8 | 148 | 5809 | 62.6 | 360 | 2 - 20 | 20 - 200 | 100 - 1000 |
| C1-Chrysenes/Benzo(a)anthracene | # | | | | | | | 2 - 20 | 20 - 200 | 100 - 1000 |
| C1-dibenz(a,h)anthracene | # | | | | | | | 2 - 20 | 20 - 200 | 100 - 1000 |
| C1-fluoranthene/pyrene | # | | | | | | | 2 - 20 | 20 - 200 | 100 - 1000 |

| | | SEDQUAL Freshwater (1) | | | SEDQUAL Marine (2) | | | Comparison values (3) | | |
|---|---|---|---|---|---|---|---|---|---|---|
| Chemical | CAS | Number of Samples | % Detected | Median of detected values ppb dw | Number of Samples | % Detected | Median of detected values ppb dw | MDL or Reference Value | 10X | 50X |
| C1-fluorenes | # | | | | | | | 2 - 20 | 20 - 200 | 100 - 1000 |
| C1-Naphthalenes | # | | | | | | | 2 - 20 | 20 - 200 | 100 - 1000 |
| C1-phenanthrene/anthracene | # | | | | | | | 2 - 20 | 20 - 200 | 100 - 1000 |
| C2-Chrysenes/Benzo(a)anthracene | # | | | | | | | 2 - 20 | 20 - 200 | 100 - 1000 |
| C2-dibenz(a,h)anthracene | # | | | | | | | 2 - 20 | 20 - 200 | 100 - 1000 |
| C2-fluorenes | # | | | | | | | 2 - 20 | 20 - 200 | 100 - 1000 |
| C2-Naphthalenes | # | | | | | | | 2 - 20 | 20 - 200 | 100 - 1000 |
| C2-phenanthrene/anthracene | # | | | | | | | 2 - 20 | 20 - 200 | 100 - 1000 |
| C3-Chrysenes/Benzo(a)anthracene | # | | | | | | | 2 - 20 | 20 - 200 | 100 - 1000 |
| C3-dibenz(a,h)anthracene | # | | | | | | | 2 - 20 | 20 - 200 | 100 - 1000 |
| C3-fluorenes | # | | | | | | | 2 - 20 | 20 - 200 | 100 - 1000 |
| C3-Naphthalenes | # | | | | | | | 2 - 20 | 20 - 200 | 100 - 1000 |
| C3-phenanthrene/anthracene | # | | | | | | | 2 - 20 | 20 - 200 | 100 - 1000 |
| C4-Chrysenes/Benzo(a)anthracene | # | | | | | | | 2 - 20 | 20 - 200 | 100 - 1000 |
| C4-Naphthalenes | # | | | | | | | 2 - 20 | 20 - 200 | 100 - 1000 |
| C4-phenanthrene/anthracene | # | | | | | | | 2 - 20 | 20 - 200 | 100 - 1000 |
| Cadmium | 7440-43-9 | 401 | 79.8 | 1500 | 6587 | 74.4 | 500 | 1500 | 15000 | 75000 |
| Chlordane | 57-74-9 | 95 | 0.0 | ND | 4491 | 64.3 | 340 | 0.1 - 1.0 | 1 - 10 | 5 - 50 |
| Chlorpyrifos | 2921-88-2 | 3 | 0.0 | ND | 3451 | 76.2 | 301 | 2.5 | 25 | 125 |
| Chromium | 7440-47-3 | 329 | 92.4 | 44300 | 5369 | 88.0 | 18154 | 85000 | 850000 | 4250000 |
| Chromium IV | # | | | | | | | 0.1 | 1 | 5 |
| Chrysene | 218-01-9 | 275 | 70.5 | 1300 | 4319 | 80.4 | 274 | 2 - 20 | 20 - 200 | 100 - 1000 |
| Copper | 7440-50-8 | 348 | 100.0 | 65600 | 5416 | 91.0 | 18000 | 53000 | 530000 | 2650000 |
| Dacthal | 1861-32-1 | | | | | | | 0.1 - 1.0 | 1 - 10 | 5 - 50 |
| Diazinon | 333-41-5 | 3 | 0.0 | ND | 2717 | 79.2 | 397 | 2.5 | 25 | 125 |
| Dibenz(a,h)anthracene | 53-70-3 | 266 | 43.6 | 300 | 4169 | 60.0 | 250 | 2 - 20 | 20 - 200 | 100 - 1000 |
| Dibenzothiophene | 132-65-0 | | | | 2222 | 84.1 | 403 | 2 - 20 | 20 - 200 | 100 - 1000 |
| Dicamba | 1918-00-9 | | | | 1894 | 76.5 | 570 | 3.5 | 35 | 175 |
| Dichlobanil | 1194-65-6 | | | | | | | 1 | 10 | 50 |
| Dieldrin | 60-57-1 | 156 | 7.7 | 18 | 3636 | 38.1 | 380 | 0.2 - 2.0 | 2 - 20 | 10 - 100 |
| Dimethyl phthalate | 131-11-3 | 192 | 16.1 | 140 | 3577 | 35.3 | 320 | 2 - 20 | 20 - 200 | 100 - 1000 |
| Di-n-butyl phthalate | 84-74-2 | 218 | 17.0 | 23 | 3547 | 39.5 | 230 | 2 - 20 | 20 - 200 | 100 - 1000 |
| Di-n-octyl phthalate | 117-84-0 | 185 | 18.4 | 46 | 3109 | 27.4 | 340 | 2 - 20 | 20 - 200 | 100 - 1000 |
| Diuron | 330-54-1 | | | | | | | 3 | 30 | 150 |
| Endosulfan | 115-29-7 | 5 | 40.0 | 0.2 | 1517 | 24.7 | 1600 | 0.1 - 1.0 | 1 - 10 | 5 - 50 |
| Endosulfan sulfate | 1031-07-8 | 146 | 6.2 | 94 | 1629 | 13.1 | 3900 | 0.2 - 2.0 | 2 - 20 | 10 - 100 |
| Endrin | 72-20-8 | 150 | 6.0 | 54 | 1477 | 7.4 | 1340 | 0.2 - 2.0 | 2 - 20 | 10 - 100 |
| Ethion | 563-12-2 | 3 | 0.0 | ND | 406 | 12.6 | 34400 | 2.5 | 25 | 125 |
| Ethoxylated nonylphenol phosphate | 51811-79-1 | | | | | | | 3 - 30 | 30 - 300 | 150 - 1500 |
| Ethylbenzene | 100-41-4 | 141 | 10.6 | 2 | 1379 | 5.1 | 8 | 0.5 - 3.2 | 5 - 32 | 25 - 160 |
| Fenitrothion | 122-14-5 | | | | | | | 2.5 | 25 | 125 |
| Fluoranthene | 206-44-0 | 280 | 76.1 | 2080 | 1955 | 72.1 | 141 | 2 - 20 | 20 - 200 | 100 - 1000 |
| Fluorene | 86-73-7 | 272 | 54.4 | 330 | 2116 | 43.0 | 32 | 2 - 20 | 20 - 200 | 100 - 1000 |

| | | SEDQUAL Freshwater (1) | | | SEDQUAL Marine (2) | | | Comparison values (3) | |
|---|---|---|---|---|---|---|---|---|---|
| Chemical | CAS | Number of Samples | % Detected | Median of detected values ppb dw | Number of Samples | % Detected | Median of detected values ppb dw | MDL or Reference Value | 10X | 50X |
| gamma-BHC | 58-89-9 | 157 | 8.3 | 19 | 2450 | 12.0 | 15 | 0.1 - 1.0 | 1 - 10 | 5 - 50 |
| Guthion | 86-50-0 | 3 | 0.0 | ND | 455 | 32.3 | 9650 | 2.5 | 25 | 125 |
| Heptachlor | 76-44-8 | 151 | 5.3 | 24 | 2593 | 9.8 | 19 | 0.1 - 1.0 | 1 - 10 | 5 - 50 |
| Heptachlor epoxide | 1024-57-3 | 156 | 3.8 | 80 | 1235 | 10.6 | 110 | 0.2 - 2.0 | 2 - 20 | 10 - 100 |
| Heptachloronaphthalene | 32241-08-0 | | | | | | | 3 - 30 / 0.5 - 5.0 | 30 - 300 / 5.0 - 50 | 150 - 1500 / 25 - 250 |
| Hexachlorobenzene | 118-74-1 | 163 | 0.0 | ND | 2891 | 14.6 | 11 | 0.1 - 1.0 / 2 - 20 | 1 - 10 / 20 - 200 | 5 - 50 / 100 - 1000 |
| Hexachlorobutadiene | 87-68-3 | 168 | 0.6 | 2 | 2849 | 10.4 | 35 | 2 -20 / 0.1 - 1.0 | 20 - 200 / 1.0 - 10 | 100 - 1000 / 5.0 - 50 |
| Hexachloroethane | 67-72-1 | 161 | 0.6 | 730 | 2417 | 8.1 | 200 | 2 - 20 | 20 - 200 | 100 - 1000 |
| Hexachloronaphthalene | 1335-87-1 | | | | | | | 3 - 30 / 0.5 - 5.0 | 30 - 300 / 5.0 - 50 | 150 - 1500 / 25 - 250 |
| Indeno(1,2,3-c,d)pyrene | 193-39-5 | 269 | 63.6 | 1200 | 2791 | 40.6 | 111 | 2 - 20 | 20 - 200 | 100 - 1000 |
| Kelthane | 115-32-2 | 15 | 0.0 | ND | | | | 1.0 - 10 | 10 - 100 | 50 - 500 |
| Lead | 7439-92-1 | 403 | 95.0 | 95000 | 4137 | 71.7 | 20000 | 20000 | 200000 | 1000000 |
| Mercury | 7439-97-6 | 372 | 82.0 | 200 | 3931 | 63.4 | 173 | 150 | 1500 | 7500 |
| Methoxychlor | 72-43-5 | 132 | 0.8 | 0.2 | 2850 | 42.7 | 23850 | 1.0 - 10 | 10 - 100 | 50 - 500 |
| Methyl parathion | 298-00-0 | 18 | 0.0 | ND | 1715 | 52.7 | 410 | 2.5 | 25 | 125 |
| Methyltin trichloride | 993-16-8 | | | | | | | 6 | 60 | 300 |
| Mirex | 2385-85-5 | 5 | 0.0 | ND | 1219 | 51.8 | 576 | 0.1 - 1.0 | 1 - 10 | 5 - 50 |
| Naphthalene | 91-20-3 | 282 | 52.5 | 510 | 2592 | 41.6 | 88 | 2 - 20 | 20 - 200 | 100 - 1000 |
| Nickel | 7440-02-0 | 274 | 98.2 | 37000 | 2199 | 82.8 | 23413 | 42000 | 420000 | 2100000 |
| N-nitroso diphenylamine | 86-30-6 | 171 | 2.9 | 10 | 2130 | 12.5 | 360 | 2 - 20 | 20 - 200 | 100 - 1000 |
| Nonylphenol | 25154-52-3 | | | | | | | 2 - 20 | 20 - 200 | 100 - 1000 |
| Octachloronaphthalene | 2234-13-1 | | | | | | | 3 - 30 / 0.5 - 5.0 | 30 - 300 / 5.0 - 50 | 150 - 1500 / 25 - 250 |
| Oxadiazon | 19666-30-9 | | | | | | | 2.0 - 10 | 20 - 100 | 100 - 500 |
| Parathion | 56-38-2 | 3 | 0.0 | ND | 408 | 30.9 | 860 | 2.5 | 25 | 125 |
| pentabromodiphenyl ether | 32534-81-9 | | | | | | | 2 - 20 / 0.3 - 3.0 | 20 - 200 / 3.0 - 30 | 100 - 1000 / 15 - 150 |
| Pentachloroanisole | 1825-21-4 | 2 | 0.0 | ND | | | | 2 - 20 / 0.1 - 1.0 | 20 - 200 / 1.0 - 10 | 100 - 1000 / 5.0 - 50 |
| Pentachloronaphthalene | 1321-64-8 | | | | | | | 3 - 30 / 0.5 - 5.0 | 30 - 300 / 5.0 - 50 | 150 - 1500 / 25 - 250 |
| Pentachlorophenol | 87-86-5 | 189 | 15.9 | 35 | 1808 | 14.2 | 44 | 10 - 60 / 1.0 - 10 | 100 - 600 / 10 - 100 | 500 - 3000 / 50 - 500 |
| Perylene | 198-55-0 | | | | 299 | 69.9 | 26 | 2 - 20 | 20 - 200 | 100 - 1000 |
| Phenanthrene | 85-01-8 | 279 | 70.3 | 1200 | 1561 | 68.7 | 89 | 2 - 20 | 20 - 200 | 100 - 1000 |
| Phenol | 108-95-2 | 157 | 21.7 | 53 | 2097 | 30.3 | 42 | 2 - 20 | 20 - 200 | 100 - 1000 |
| Polybrominated terphenyls | # | | | | | | | 4 | 40 | 200 |
| Polychlorinated alkenes | # | | | | | | | 5 - 50 / 1.0 - 10 | 50 - 500 / 10 - 100 | 250 - 2500 / 50 - 500 |
| Polychlorinated Biphenyls | 1336-36-3 | 250 | 24.8 | 310 | 2420 | 49.3 | 136 | 2.0 - 20 | 20 - 200 | 100 - 1000 |
| Polychlorinated Terphenyls | 61788-33-8 | | | | | | | 4 | 40 | 200 |
| Polychlorodibenzodioxins | # | | | | 453 | 26.9 | 252 | 0.0001 - 0.001 | 0.001 - 0.01 | 0.005 - 0.05 |
| Polychlorodibenzofurans | # | | | | 304 | 29.3 | 100 | 0.0001 - 0.001 | 0.001 - 0.01 | 0.005 - 0.05 |
| Pronamide | 23950-58-5 | | | | | | | 1.0 - 10 | 10 - 100 | 50 - 500 |
| Pyrene | 129-00-0 | 278 | 76.3 | 2200 | 1591 | 77.3 | 170 | 2 - 20 | 20 - 200 | 100 - 1000 |
| Selenium | 7782-49-2 | 170 | 24.7 | 680 | 1264 | 22.2 | 700 | 200 (MDL) | 2000 | 10000 |
| Silver | 7440-22-4 | 199 | 46.7 | 1000 | 1944 | 50.7 | 530 | 320 | 3200 | 16000 |
| Tetrachloroethene | 127-18-4 | 110 | 1.8 | 10 | 918 | 10.9 | 107 | 0.5 - 3.2 | 5 - 32 | 25 - 160 |
| Tetrachloronaphthalene | 1335-88-2 | | | | | | | 3 - 30 / 0.5 - 5.0 | 30 - 300 / 5.0 - 50 | 150 - 1500 / 25 - 250 |

| | | SEDQUAL Freshwater (1) | | | | SEDQUAL Marine (2) | | | Comparison values (3) | |
|---|---|---|---|---|---|---|---|---|---|---|
| Chemical | CAS | Number of Samples | % Detected | Median of detected values ppb dw | Number of Samples | % Detected | Median of detected values ppb dw | MDL or Reference Value | 10X | 50X |
| Tetradifon | 116-29-0 | | | | | | | 1 | 10 | 50 |
| Tetraethyltin | 597-64-8 | | | | | | | 6 | 60 | 300 |
| Total benzofluoranthenes (b+k (+j)) | # | 270 | 69.6 | 2400 | 2389 | 83.1 | 600 | 20 | 200 | 1000 |
| Total DDT,DDD,DDE | # | 151 | 13.9 | 22 | 1777 | 90.7 | 6 | 2 | 20 | 100 |
| Toxaphene | 8001-35-2 | 151 | 0.0 | ND | 752 | 0.0 | ND | 5.0 - 50 | 50 - 500 | 250 - 2500 |
| Tributyltin | 688-73-3 | 8 | 87.5 | 1151 | 695 | 77.6 | 16 | 6 | 60 | 300 |
| Trichloroethene | 79-01-6 | 110 | 2.7 | 0.6 | 1128 | 3.8 | 3 | 0.5 - 3.2 | 5 - 32 | 25 - 160 |
| Trichloronaphthalene | 1321-65-9 | | | | | | | 3 - 30 / 0.5 - 5.0 | 30 - 300 / 5.0 - 50 | 150 - 1500 / 25 - 250 |
| Trifluralin | 1582-09-8 | | | | | | | 1.0 - 5.0 | 10 - 50 | 50 - 250 |
| Triphenyltin chloride | 639-58-7 | | | | | | | 12 | 120 | 600 |
| Zinc | 7440-66-6 | 329 | 100.0 | 270000 | 2485 | 99.6 | 82000 | 103000 | 1030000 | 5150000 |
| | | | | | | | | | | |
| All data reported in ppb dry weight | | | | | | | | | | |
| (1) Based on a query of all Freshwater SEDQUAL stations from WA State and the Columbia River conducted March 2002 | | | | | | | | | | |
| (2) Marine SEDQUAL query included all stations in Puget Sound - conducted April 2002 | | | | | | | | | | |
| (3) Method Detection Limits for organics from Table 3 (Analytical Methods Information for BCOCs) | | | | | | | | | | |
| Reference concentrations for trace metals are the reference area performance standards for Puget Sound (90th percentile of the concentration range) given in PSEP (1991) | | | | | | | | | | |
| except for selenium and antimony which are based on MDLs | | | | | | | | | | |

| | | SEDQUAL (1) | | | | | | | | PSAMP (2) | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Chemical | CAS | Number of Samples | % Detected | Minimum Detected Values (ppb) wet | Maximum Detected Values (ppb) wet | 95th%ile (or max) of detected data (ppb) wet | Chemical Qualifier | 95th%ile (or max) of ND data (ppb) wet (3) | Chemical Qualifier | Number of Samples | % Detected | Minimum Detected Values (ppb) wet | Maximum Detected Values (ppb) wet | 95th %ile of detected data (ppb) wet | Chemical Qualifier |
| 1,2,3,4-Tetrachlorobenzene | 634-66-2 | | | | | | | | | | | | | | |
| 1,2,3,5-Tetrachlorobenzene | 634-90-2 | | | | | | | | | | | | | | |
| 1,2,3-Trichlorobenzene | 87-61-6 | | | | | | | | | | | | | | |
| 1,2,4,5-Tetrachlorobenzene | 95-94-3 | | | | | | | | | | | | | | |
| 1,2,4-Trichlorobenzene | 120-82-1 | 178 | 0.0 | ND | ND | | | 3200 | U | 173 | 0 | | | | |
| 1,2-Dichlorobenzene | 95-50-1 | 189 | 0.0 | ND | ND | | | 3100 | U | 173 | 0 | | | | |
| 1,3,5-Trichlorobenzene | 108-70-3 | | | | | | | | | | | | | | |
| 1,3-Dichlorobenzene | 541-73-1 | 189 | 0.0 | ND | ND | | | 3100 | U | 173 | 0 | | | | |
| 1,4-Dichlorobenzene | 106-46-7 | 189 | 0.0 | ND | ND | | | 3100 | U | 173 | 0 | | | | |
| 1-methylnaphthalene | 90-12-0 | 4 | 0.0 | ND | ND | | | 82 | U | | | | | | |
| 1-methylphenanthrene | 832-69-9 | | | | | | | | | | | | | | |
| 2,3,7,8-Tetrachlorodibenzo-p-dioxin | 1746-01-6 | 45 | 46.7 | 0.00027 | 0.026 | 0.0029 | NE | | | | | | | | |
| 2,4'-DDD | 53-19-0 | | | | | | | | | 191 | 3.1 | 0.71 | 9.8 | 9.6 | 90th - liver |
| 2,4'-DDE | 3424-82-6 | | | | | | | | | | | | | | |
| 2,4'-DDT | 789-02-6 | | | | | | | | | 127 | 2.3 | 2.5 | 37 | 37.0 | max - liver |
| 2,6-Dimethyl naphthalene | 581-42-0 | | | | | | | | | | | | | | |
| 2-methylnaphthalene | 91-57-6 | 195 | 1.0 | 0.8 | 1 | 1 | E | | | 171 | 0 | | | | |
| 4,4'-DDD | 72-54-8 | 374 | 0.3 | 16 | 16 | 16 | | | | 562 | 24.7 | 1.6 | 157 | 84.5 | liver |
| 4,4'-DDE | 72-55-9 | 461 | 26.5 | 0.6 | 410 | 19 | | | | 515 | 67.3 | 7.6 | 250 | 169.0 | liver |
| 4,4'-DDT | 50-29-3 | 442 | 15.4 | 0.1 | 69.9 | 45.3 | | | | 503 | 4.9 | 1.2 | 24 | 23.4 | liver |
| 4,4'-Dichlorobenzophenone | 90-98-2 | | | | | | | | | | | | | | |
| 4-bromophenylphenylether | 101-55-3 | | | | | | | | | 105 | 0 | | | | |
| 4-Nonylphenol | 84852-15-3 | | | | | | | | | | | | | | |
| Acenaphthene | 83-32-9 | 197 | 0.5 | 16 | 16 | 16 | | | | 176 | 1.7 | 60 | 160 | 160.0 | max - liver |
| Acenaphthylene | 208-96-8 | 197 | 0.0 | ND | ND | | | 3100 | U | 173 | 0 | | | | |
| Aldrin | 309-00-2 | 452 | 4.6 | 0.3 | 5.7 | 1.4 | E | | | 298 | 0 | | | | |
| Alpha-Benzene Hexachloride (BHC) | 319-84-6 | | | | | | | | | 331 | 3 | 0.9 | 2.4 | 2.2 | 90th -whole body |
| Anthracene | 120-12-7 | 195 | 0.5 | 160 | 160 | | | 160 | | 173 | 0 | | | | |
| Antimony | 7440-36-0 | 235 | 17.0 | 24 | 2200 | | | 1200 | | | | | | | |
| Arsenic | 7440-38-2 | 458 | 98.3 | 160 | 32000 | | | 15900 | | 297 | 100 | 200 | 60200 | 26850.0 | liver |
| Benzo(a)anthracene | 56-55-3 | 194 | 2.1 | 7 | 220 | | | 17 | ZE | 173 | 0 | | | | |
| Benzo(a)pyrene | 50-32-8 | 203 | 2.0 | 8.7 | 190 | | | 28 | ZE | 173 | 0 | | | | |
| Benzo(b)fluoranthene | 205-99-2 | 137 | 2.2 | 4 | 400 | | | 4 | E | 173 | 0 | | | | |
| Benzo(e)pyrene | 192-97-2 | | | | | | | | | | | | | | |
| Benzo(g,h,i)perylene | 191-24-2 | 203 | 0.0 | ND | ND | | | 3000 | U | 173 | 0 | | | | |
| Benzo(k)fluoranthene | 207-08-9 | 137 | 0.7 | 20 | 20 | 20 | E | | | 173 | 0 | | | | |
| Biphenyl | 92-52-4 | | | | | | | | | | | | | | |
| Bis(2-ethylhexyl) phthalate | 117-81-7 | 176 | 5.7 | 8.7 | 5700 | 3000 | | | | 159 | 32.1 | 20 | 3683 | 1862.0 | muscle |
| Bromoxynil | 1689-84-5 | | | | | | | | | | | | | | |
| Butyl benzyl phthalate | 85-68-7 | 187 | 0.0 | ND | ND | | | 3000 | U | 173 | 0.6 | 220 | 220 | 220.0 | max - muscle |
| C1-Chrysenes/Benzo(a)anthracene | # | | | | | | | | | | | | | | |
| C1-dibenz(a,h)anthracene | # | | | | | | | | | | | | | | |
| C1-fluoranthene/pyrene | # | | | | | | | | | | | | | | |
| C1-fluorenes | # | | | | | | | | | | | | | | |
| C1-Naphthalenes | # | | | | | | | | | | | | | | |

| Chemical | CAS | Number of Samples | % Detected | Minimum Detected Values (ppb) wet | Maximum Detected Values (ppb) wet | 95th%ile (or max) of detected data (ppb) wet | Chemical Qualifier | 95th%ile (or max) of ND data (ppb) wet (3) | Chemical Qualifier | Number of Samples | % Detected | Minimum Detected Values (ppb) wet | Maximum Detected Values (ppb) wet | 95th %ile of detected data (ppb) wet | Chemical Qualifier |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| C1-phenanthrene/anthracene | # | | | | | | | | | | | | | | |
| C2-Chrysenes/Benzo(a)anthracene | # | | | | | | | | | | | | | | |
| C2-dibenz(a,h)anthracene | # | | | | | | | | | | | | | | |
| C2-fluorenes | # | | | | | | | | | | | | | | |
| C2-Naphthalenes | # | | | | | | | | | | | | | | |
| C2-phenanthrene/anthracene | # | | | | | | | | | | | | | | |
| C3-Chrysenes/Benzo(a)anthracene | # | | | | | | | | | | | | | | |
| C3-dibenz(a,h)anthracene | # | | | | | | | | | | | | | | |
| C3-fluorenes | # | | | | | | | | | | | | | | |
| C3-Naphthalenes | # | | | | | | | | | | | | | | |
| C3-phenanthrene/anthracene | # | | | | | | | | | | | | | | |
| C4-Chrysenes/Benzo(a)anthracene | # | | | | | | | | | | | | | | |
| C4-Naphthalenes | # | | | | | | | | | | | | | | |
| C4-phenanthrene/anthracene | # | | | | | | | | | | | | | | |
| Cadmium | 7440-43-9 | 447 | 68.7 | 1 | 2900 | 1500 | | | | | | | | | |
| Chlordane | 57-74-9 | 204 | 0.0 | ND | ND | | | 50 | U | 305 | 17 | 12.8 | 104.5 | 101.7 | liver |
| Chlorpyrifos | 2921-88-2 | 24 | 0.0 | ND | ND | | | 9 | UE ** | | | | | | |
| Chromium | 7440-47-3 | 241 | 56.4 | 50 | 43100 | 1500 | | | | | | | | | |
| Chromium IV | # | | | | | | | | | | | | | | |
| Chrysene | 218-01-9 | 206 | 1.9 | 8 | 400 | 30 | E | | | 173 | 0 | | | | |
| Copper | 7440-50-8 | 451 | 82.9 | 100 | 30200 | 8700 | | | | 294 | 100 | 2600 | 25400 | 12425.0 | liver |
| Dacthal | 1861-32-1 | | | | | | | | | | | | | | |
| Diazinon | 333-41-5 | 37 | 0.0 | ND | ND | | | 12 | U ** | | | | | | |
| Dibenz(a,h)anthracene | 53-70-3 | 203 | 0.0 | ND | ND | | | 3000 | U | 132 | 0 | | | | |
| Dibenzothiophene | 132-65-0 | | | | | | | | | | | | | | |
| Dicamba | 1918-00-9 | | | | | | | | | | | | | | |
| Dichlobenil | 1194-65-6 | | | | | | | | | | | | | | |
| Dieldrin | 60-57-1 | 452 | 5.3 | 0.2 | 6 | 3 | | | | 298 | 0.67 | 0.39 | 0.61 | 0.6 | max - muscle |
| Dimethyl phthalate | 131-11-3 | 178 | 0.0 | ND | ND | | | 3200 | U | 173 | 0 | | | | |
| Di-n-butyl phthalate | 84-74-2 | 176 | 2.3 | 530 | 5600 | 4400 | | | | 133 | 5.26 | 20 | 90 | 88.0 | 90th - muscle |
| Di-n-octyl phthalate | 117-84-0 | 184 | 0.5 | 460 | 460 | 460 | BE - max | | | 173 | 0 | | | | |
| Diuron | 330-54-1 | | | | | | | | | | | | | | |
| Endosulfan | 115-29-7 | 8 | 0.0 | ND | ND | | | 2 | U | 298 | 0 | | | | |
| Endosulfan sulfate | 1031-07-8 | 217 | 0.9 | 2.5 | 3.6 | 3.6 | E -max | | | 298 | 0 | | | | |
| Endrin | 72-20-8 | 350 | 0.6 | 0.8 | 1.8 | 1.8 | E - max | | | 298 | 0 | | | | |
| Ethion | 563-12-2 | 24 | 0.0 | ND | ND | | | 25 | U ** | | | | | | |
| Ethoxylated nonylphenol phosphate | 51811-79-1 | | | | | | | | | | | | | | |
| Ethylbenzene | 100-41-4 | 20 | 0.0 | ND | ND | | | 100 | U ** | | | | | | |
| Fenitrothion | 122-14-5 | | | | | | | | | | | | | | |
| Fluoranthene | 206-44-0 | 264 | 29.9 | 0.5 | 740 | 358.3 | | | | 173 | 0 | | | | |
| Fluorene | 86-73-7 | 197 | 0.0 | ND | ND | | | 3100 | U | 174 | 0.57 | 130 | 130 | 130.0 | max |
| Gamma-Benzene Hexachloride | 58-89-9 | 452 | 1.8 | 0.2 | 2.3 | 1.5 | E | | | 307 | 0 | | | | |
| Guthion | 86-50-0 | 37 | 0.0 | ND | ND | | | 667 | U ** | | | | | | |
| Heptachlor | 76-44-8 | 432 | 3.5 | 0.5 | 7.5 | 3.4 | E | | | 307 | 0 | | | | |
| Heptachlor epoxide | 1024-57-3 | 217 | 0.0 | ND | ND | | | 100 | U | 322 | 0 | | | | |
| Heptachloronaphthalene | 32241-08-0 | | | | | | | | | | | | | | |

| Chemical | CAS | Number of Samples | % Detected | Minimum Detected Values (ppb) wet | Maximum Detected Values (ppb) wet | 95th%ile (or max) of detected data (ppb) wet | Chemical Qualifier | 95th%ile (or max) of ND data (ppb) wet (3) | Chemical Qualifier | Number of Samples | % Detected | Minimum Detected Values (ppb) wet | Maximum Detected Values (ppb) wet | 95th %ile of detected data (ppb) wet | Chemical Qualifier |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Hexachlorobenzene | 118-74-1 | 280 | 16.8 | 0.52 | 10 | 2 | | | | 370 | 17 | 0.67 | 12 | 2.9 | liver |
| Hexachlorobutadiene | 87-68-3 | 270 | 1.9 | 0.8 | 1.79 | 1.14 | | | | 173 | 0 | | | | |
| Hexachloroethane | 67-72-1 | 170 | 0.0 | ND | ND | | | 3200 | U | 156 | 0 | | | | |
| Hexachloronaphthalene | 1335-87-1 | | | | | | | | | | | | | | |
| Indeno(1,2,3-c,d)pyrene | 193-39-5 | 203 | 0.0 | ND | ND | | | 3000 | U | 173 | 0 | | | | |
| Kelthane | 115-32-2 | | | | | | | | | | | | | | |
| Lead | 7439-92-1 | 440 | 82.3 | 1 | 5200 | 1700 | | | | 368 | 36 | 60 | 4710 | 2995.0 | liver |
| Mercury | 7439-97-6 | 585 | 81.9 | 2 | 300 | 130 | | | | 674 | 99.8 | 9.6 | 1440 | 567.0 | muscle |
| Methoxychlor | 72-43-5 | 106 | 6.6 | 1.8 | 48.5 | 27.6 | E | | | 259 | 0 | | | | |
| Methyl parathion | 298-00-0 | 39 | 7.7 | 25 | 34 | 33 | E | | | | | | | | |
| Methyltin trichloride | 993-16-8 | | | | | | | | | | | | | | |
| Mirex | 2385-85-5 | | | | | | | | | | | | | | |
| Naphthalene | 91-20-3 | 197 | 0.5 | 28 | 28 | 28 | E - max | | | 173 | 1.15 | 88 | 120 | 120.0 | max - liver |
| Nickel | 7440-02-0 | 274 | 41.6 | 100 | 49000 | 1790 | E | | | | | | | | |
| N-nitroso diphenylamine | 86-30-6 | 178 | 0.0 | ND | ND | | | 3200 | U | 173 | 0.6 | 3.7 | 3.7 | 3.7 | max |
| Nonylphenol | 25154-52-3 | | | | | | | | | | | | | | |
| Octachloronaphthalene | 2234-13-1 | | | | | | | | | | | | | | |
| Oxadiazon | 19666-30-9 | | | | | | | | | | | | | | |
| Parathion | 56-38-2 | 24 | 0.0 | ND | ND | | | 12 | U ** | | | | | | |
| pentabromodiphenyl ether | 32534-81-9 | | | | | | | | | | | | | | |
| Pentachloroanisole | 1825-21-4 | | | | | | | | | | | | | | |
| Pentachloronaphthalene | 1321-64-8 | | | | | | | | | | | | | | |
| Pentachlorophenol | 87-86-5 | 192 | 1.0 | 1.5 | 4300 | 4300 | max | | | 90 | 0 | | | | |
| Perylene | 198-55-0 | | | | | | | | | | | | | | |
| Phenanthrene | 85-01-8 | 195 | 5.6 | 2 | 330 | 39 | E | | | 175 | 4.6 | 120 | 250 | 250.0 | max - liver |
| Phenol | 108-95-2 | 188 | 2.1 | 14 | 390 | 65 | E | | | 153 | 0.7 | 66 | 66 | 66.0 | max |
| Polybrominated terphenyls | # | | | | | | | | | | | | | | |
| Polychlorinated alkenes | # | | | | | | | | | | | | | | |
| Total PCBs (4) | 1336-36-3 | 510 | 60.6 | 3 | 1990 | 780 | | | | 238 | 100 | 170 | 13000 | 8180.0 | liver |
| Polychlorinated Terphenyls | 61788-33-8 | | | | | | | | | | | | | | |
| Polychlorodibenzodioxins | # | | | | | | | | | | | | | | |
| Polychlorodibenzofurans | # | | | | | | | | | | | | | | |
| Pronamide | 23950-58-5 | | | | | | | | | | | | | | |
| Pyrene | 129-00-0 | 206 | 4.9 | 6 | 1600 | 52 | | | | 173 | 0 | | | | |
| Selenium | 7782-49-2 | 262 | 85.9 | 100 | 63500 | 3600 | SE | | | | | | | | |
| Silver | 7440-22-4 | 351 | 41.0 | 0.5 | 65000 | 3200 | NE | | | | | | | | |
| Tetrachloroethene | 127-18-4 | 20 | 0.0 | ND | ND | | | 10 | U ** | | | | | | |
| Tetrachloronaphthalene | 1335-88-2 | | | | | | | | | | | | | | |
| Tetradifon | 116-29-0 | | | | | | | | | | | | | | |
| Tetraethyltin | 597-64-8 | | | | | | | | | | | | | | |
| Total benzofluoranthenes (b+k (+j)) | # | 66 | 3.0 | 17 | 52 | 52 | ZE | | | | | | | | |
| Total pp,-DDT,-DDD,-DDE | # | | | | | | | | | 42 | 100 | 2.6 | 260 | 182.0 | |
| Toxaphene | 8001-35-2 | 106 | 0.0 | ND | ND | | | 495 | U | 216 | 0 | | | | |
| Tributyltin | 688-73-3 | 272 | 64.7 | 1.7 | 630.4 | 215.4 | | | | 9 | 100 | 0.46 | 9.38 | 8.2 | 90th |
| Trichloroethene | 79-01-6 | 20 | 15.0 | 5 | 360 | 9.2 | ** | | | | | | | | |
| Trichloronaphthalene | 1321-65-9 | | | | | | | | | | | | | | |

| Chemical | CAS | Number of Samples | % Detected | Minimum Detected Values (ppb) wet | Maximum Detected Values (ppb) wet | 95th%ile (or max) of detected data (ppb) wet | Chemical Qualifier | 95th%ile (or max) of ND data (ppb) wet (3) | Chemical Qualifier | Number of Samples | % Detected | Minimum Detected Values (ppb) wet | Maximum Detected Values (ppb) wet | 95th %ile of detected data (ppb) wet | Chemical Qualifier |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Trifluralin | 1582-09-8 | | | | | | | | | | | | | | |
| Triphenyltin chloride | 639-58-7 | | | | | | | | | | | | | | |
| Zinc | 7440-66-6 | 435 | 95.2 | 1700 | 110000 | 44000 | | | | | | | | | |
| | | | | | | | | | | | | | | | |
| (1) Based on a 3/2002 analysis of all non-PSAMP fish tissue data from Sedqual. | | | | | | | | | | | | | | | |
| SEDQUAL chemical qualifier codes are as follows: | | | | | | | | | | | | | | | |
| E = estimated value; Z = blank corrected; value still above detection limit; S = Value estimated from nearby stations; U = undetected; N = Estimate based on presumptive evidence; M = Value is a mean | | | | | | | | | | | | | | | |
| ** = data did not meet minimum tissue data requirements established by DMMP for this exercise. | | | | | | | | | | | | | | | |
| ND = not detected | | | | | | | | | | | | | | | |
| (2) Based on 10/2001 analysis of PSAMP Fish Component data limited to flatfish (English sole, starry flounder), rockfish (copper, quillback and brown), and Pacific herring. Only stations classified by PSAMP as Urban or Near urban were used. | | | | | | | | | | | | | | | |
| Summary stats were computed using only samples that had detected concentrations. All non-detects with MDL> 50 ppb were excluded from these summaries. | | | | | | | | | | | | | | | |
| (3) 95th %ile of nondetected data only calculated when all data are non-detect | | | | | | | | | | | | | | | |
| (4) SEDQUAL PCB data is total Aroclors; PSAMP PCB data is total PCBs estimated using HPLC/PDA method | | | | | | | | | | | | | | | |

| Chemical | CAS | RfD (1) | CSF (2) | IRIS WOE Score (3) |
|---|---|---|---|---|
| 1,2,3,4-Tetrachlorobenzene | 634-66-2 | - | - | - |
| 1,2,3,5-Tetrachlorobenzene | 634-90-2 | - | - | - |
| 1,2,3-Trichlorobenzene | 87-61-6 | - | - | - |
| 1,2,4,5-Tetrachlorobenzene | 95-94-3 | 3.00E-04 | - | - |
| 1,2,4-Trichlorobenzene | 120-82-1 | 1.00E-02 | - | D |
| 1,2-Dichlorobenzene | 95-50-1 | 9.00E-02 | | D |
| 1,3,5-Trichlorobenzene | 108-70-3 | - | - | - |
| 1,3-Dichlorobenzene | 54-17-1 | | | D |
| 1,4-Dichlorobenzene | 106-46-7 | | | |
| 1-methylnaphthalene | 90-12-0 | - | - | - |
| 1-methylphenanthrene | 832-69-9 | - | - | - |
| 2,3,7,8-Tetrachlorodibenzo-p-dioxin (4) | 1746-01-6 | - | 1.50E+05 | - |
| 2,4'-DDD | 53-19-0 | | | |
| 2,4'-DDE | 3424-82-6 | | | |
| 2,4'-DDT | 789-02-6 | | | |
| 2,6-Dimethyl naphthalene | 581-42-0 | - | - | - |
| 2-methylnaphthalene | 91-57-6 | | | |
| 4,4'-DDD | 72-54-8 | - | 2.40E-01 | B |
| 4,4'-DDE | 72-55-9 | | | B |
| 4,4'-DDT | 50-29-3 | 5.00E-04 | 3.40E-01 | B |
| 4,4'-Dichlorobenzophenone | 90-98-2 | - | - | - |
| 4-bromophenylphenylether | 101-55-3 | | | |
| 4-Nonylphenol, branched | 84852-15-3 | - | - | - |
| Acenaphthene | 83-32-9 | 6.00E-02 | - | - |
| Acenaphthylene | 208-96-8 | - | - | D |
| Aldrin | 309-00-2 | 3.00E-05 | 1.70E+01 | B |
| Alpha-Benzene Hexachloride | 319-84-6 | - | 6.30E+00 | B |
| Anthracene | 120-12-7 | 3.00E-01 | - | D |
| Antimony | 7440-36-0 | 4.00E-04 | - | - |
| Arsenic | 7440-38-2 | 3.00E-04 | 1.50E+00 | A |
| Benzo(a)anthracene | 56-55-3 | - | 1.10E+00 | B |
| Benzo(a)pyrene | 50-32-8 | - | 7.30E+00 | B |
| Benzo(b)fluoranthene | 205-99-2 | - | 1.20E+00 | B |
| Benzo(e)pyrene | 192-97-2 | - | - | - |
| Benzo(g,h,i)perylene | 191-24-2 | - | - | D |
| Benzo(k)fluoranthene | 207-08-9 | - | 1.20E+00 | B |
| Biphenyl | 92-52-4 | 5.00E-02 | - | D |
| Bis(2-ethylhexyl) phthalate | 117-81-7 | 2.00E-02 | 1.40E-02 | B |
| Bromoxynil | 1689-84-5 | 2.00E-02 | - | - |
| Butyl benzyl phthalate | 85-68-7 | 2.00E-01 | - | C |
| C1-Chrysenes/Benzo(a)anthracene | # | | | |
| C1-dibenz(a,h)anthracene | # | | | |
| C1-fluoranthene/pyrene | # | | | |
| C1-fluorenes | # | | | |
| C1-Naphthalenes | # | | | |
| C1-phenanthrene/anthracene | # | | | |
| C2-Chrysenes/Benzo(a)anthracene | # | | | |
| C2-dibenz(a,h)anthracene | # | | | |
| C2-fluorenes | # | | | |
| C2-Naphthalenes | # | | | |

| Chemical | CAS | RfD (1) | CSF (2) | IRIS WOE Score (3) |
|---|---|---|---|---|
| C2-phenanthrene/anthracene | # | | | |
| C3-Chrysenes/Benzo(a)anthracene | # | | | |
| C3-dibenz(a,h)anthracene | # | | | |
| C3-fluorenes | # | | | |
| C3-Naphthalenes | # | | | |
| C3-phenanthrene/anthracene | # | | | |
| C4-Chrysenes/Benzo(a)anthracene | # | | | |
| C4-Naphthalenes | # | | | |
| C4-phenanthrene/anthracene | # | | | |
| Cadmium | 7440-43-9 | 1.00 E-03 | - | B |
| Chlordane | 57-74-9 | 6.00E-05 | 1.30E+00 | B |
| Chlorpyrifos | 2921-88-2 | 3.00E-03 | - | - |
| Chromium | 7440-47-3 | - | - | - |
| Chromium IV | # | 3.00E-03 | - | D |
| Chrysene | 218-01-9 | - | 3.20E-02 | B |
| Copper | 7440-50-8 | - | - | - |
| Dacthal | 1861-32-1 | 1.00E-02 | - | - |
| Diazinon | 333-41-5 | 9.00E-04 | - | - |
| Dibenz(a,h)anthracene | 53-70-3 | - | 8.10E+00 | B |
| Dibenzothiophene | 132-65-0 | - | - | - |
| Dicamba | 1918-00-9 | 3.00E-02 | | |
| Dichlobenil | 1194-65-6 | 5.00E-04 | - | - |
| Dieldrin | 60-57-1 | 5.00E-05 | 1.60E+01 | B |
| Dimethyl phthalate | 131-11-3 | - | - | D |
| Di-n-butyl phthalate | 84-74-2 | 1.00E-01 | - | D |
| Di-n-octyl phthalate | 117-84-0 | 2.00E-02 | - | - |
| Diuron | 330-54-1 | 2.00E-03 | | |
| Endosulfan | 115-29-7 | 6.00E-03 | - | - |
| Endosulfan sulfate | 1031-07-8 | - | - | - |
| Endrin | 72-20-8 | 3.00E-04 | | D |
| Ethion | 563-12-2 | 5.00E-04 | - | - |
| Ethoxylated nonylphenol phosphate | 51811-79-1 | - | - | - |
| Ethylbenzene | 100-41-4 | 1.00E-01 | - | D |
| Fenitrothion | 122-14-5 | - | - | - |
| Fluoranthene | 206-44-0 | 4.00E-02 | - | D |
| Fluorene | 86-73-7 | 4.00E-02 | - | D |
| gamma-BHC /gamma-Hexachlorocyclohexane | 58-89-9 | 3.00E-04 | 1.30E+00 | - |
| Guthion | 86-50-0 | - | - | - |
| Heptachlor | 76-44-8 | 5.00E-04 | 4.50E+00 | B |
| Heptachlor epoxide | 1024-57-3 | 1.30E-05 | 9.10E+00 | B |
| Heptachloronaphthalene | 32241-08-0 | - | - | - |
| Hexachlorobenzene | 118-74-1 | 8.00E-04 | 1.60E+00 | B |
| Hexachlorobutadiene | 87-68-3 | 2.00E-04 | 7.80E-02 | C |
| Hexachloroethane | 67-72-1 | 1.00E-03 | 1.40E-02 | C |
| Hexachloronaphthalene | 1335-87-1 | - | - | - |
| Indeno(1,2,3-c,d)pyrene | 193-39-5 | - | 4.00E-01 | B |
| Kelthane | 115-32-2 | - | - | |
| Lead | 7439-92-1 | - | - | - |
| Mercury | 7439-97-6 | - | - | D |
| Methoxychlor | 72-43-5 | 5.00E-03 | - | D |

| Chemical | CAS | RfD (1) | CSF (2) | IRIS WOE Score (3) |
|---|---|---|---|---|
| Methyl parathion | 298-00-0 | 2.50E-04 | - | - |
| Methyltin trichloride | 993-16-8 | - | - | - |
| Mirex | 2385-85-5 | 2.00E-04 | | |
| Naphthalene | 91-20-3 | 2.00E-02 | - | C |
| Nickel | 7440-02-0 | 2.00E-02 | - | - |
| N-nitroso diphenylamine | 86-30-6 | - | 4.90E-03 | B |
| Nonylphenol | 25154-52-3 | - | - | - |
| Octachloronaphthalene | 2234-13-1 | - | - | - |
| Oxadiazon | 19666-30-9 | 5.00E-03 | | |
| Parathion | 56-38-2 | 6.00E-03 | - | C |
| pentabromodiphenyl ether | 32534-81-9 | 2.00E-03 | | D |
| Pentachloroanisole | 1825-21-4 | - | - | - |
| Pentachloronaphthalene | 1321-64-8 | - | - | - |
| Pentachlorophenol | 87-86-5 | 3.00E-02 | 1.20E-01 | B |
| Perylene | 198-55-0 | - | - | - |
| Phenanthrene | 85-01-8 | - | - | D |
| Phenol | 108-95-2 | 6.00E-01 | - | D |
| Polybrominated terphenyls | # | | | |
| Polychlorinated alkenes | # | | | |
| Polychlorinated Biphenyls | 1336-36-3 | 7.00E-05 | 2.00E+00 | B |
| Polychlorinated Terphenyls | 61788-33-8 | - | - | - |
| Polychlorodibenzodioxins | # | | | |
| Polychlorodibenzofurans | # | | | |
| Pronamide | 23950-58-5 | 7.50E-02 | - | - |
| Pyrene | 129-00-0 | 3.00E-02 | - | D |
| Selenium | 7782-49-2 | 5.00E-03 | - | |
| Silver | 7440-22-4 | 5.00E-03 | - | D |
| Tetrachloroethene | 127-18-4 | 1.00E-02 | 5.10E-02 | - |
| Tetrachloronaphthalene | 1335-88-2 | - | - | - |
| Tetradifon | 116-29-0 | - | - | - |
| Tetraethyltin | 597-64-8 | - | - | - |
| Total benzofluoranthenes (b+k (+j)) | # | | | |
| Total pp,-DDT,-DDD,-DDE | # | | | |
| Toxaphene | 8001-35-2 | - | 1.10E+00 | B |
| Tributyltin | 688-73-3 | - | - | - |
| Trichloroethene | 79-01-6 | - | - | |
| Trichloronaphthalene | 1321-65-9 | - | - | - |
| Trifluralin | 1582-09-8 | 7.50E-03 | 7.70E-03 | C |
| Triphenyltin chloride | 639-58-7 | - | - | - |
| Zinc | 7440-66-6 | 3.00E-01 | - | D |
| | | | | |
| (1) Reference dose from EPA's Waste Minimization Prioritization Tool (USEPA,1998) or from IRIS web site (USEPA, 2001a). | | | | |
| Units are in mg/kg/day. | | | | |
| (2) Cancer Slope Factor from EPA's Waste Minimization Prioritization Tool (USEPA,1998) or from IRIS web site (USEPA, 2001a). | | | | |
| Units are per mg/kgBW/day | | | | |
| (3) IRIS Weight of Evidence Score from EPA's Waste Minimization Prioritization Tool (USEPA,1998) or from IRIS web site (USEPA, 2001a). | | | | |
| (4) CSF for 2,3,7,8-TCDD from HEAST (USEPA, 2004). | | | | |

| Chemical | CAS | ERED/URS | | | FCV | |
|---|---|---|---|---|---|---|
| | | LOED Screening Value (mg/kg ww) | # Data Points (1) | Range of Data | (ug/L) (2) | Qualifier (3) |
| 1,2,3,4-Tetrachlorobenzene | 634-66-2 | 432 | 4 {4} | 432 - 700 | 410 | |
| 1,2,3,5-Tetrachlorobenzene | 634-90-2 | 8.24 | 1 {1} | 8.24 | 830 | |
| 1,2,3-Trichlorobenzene | 87-61-6 | 16.8 | 3 {6} | 16.8 - 940 | 200 | |
| 1,2,4,5-Tetrachlorobenzene | 95-94-3 | 3.18 | 14 | 2.99 - 2504 | | |
| 1,2,4-Trichlorobenzene | 120-82-1 | 220 | 10 {5} | 220 - 4170 | | |
| 1,2-Dichlorobenzene | 95-50-1 | 162 | 1 {1} | 162 | 14 | |
| 1,3,5-Trichlorobenzene | 108-70-3 | 1.35 | 2 | 1.35 - 1216 | 360 | |
| 1,3-Dichlorobenzene | 54-17-1 | 170 | 2 {1} | 170 - 441 | 71.31 | |
| 1,4-Dichlorobenzene | 106-46-7 | 103 | 4 {3} | 103 - 706 | 15.11 | |
| 1-methylnaphthalene | 90-12-0 | | {1} | | | |
| 1-methylphenanthrene | 832-69-9 | | | | | |
| 2,3,7,8-Tetrachlorodibenzo-p-dioxin | 1746-01-6 | 0.000058 | 74 {18} | 0.00004 – 0.3 | 1.61 | |
| 2,4'-DDD | 53-19-0 | | | | | |
| 2,4'-DDE | 3424-82-6 | 19.6 | 1 | 19.6 | | |
| 2,4'-DDT | 789-02-6 | | | | | |
| 2,6-Dimethyl naphthalene | 581-42-0 | | | | | |
| 2-methylnaphthalene | 91-57-6 | 242 | 1 | 242 | 433 | |
| 4,4'-DDD | 72-54-8 | 0.6 | 5 | 0.6 – 84.2 | 0.18 | A |
| 4,4'-DDE | 72-55-9 | 0.885 | 9 | 0.885 - 431 | 0.30 | |
| 4,4'-DDT | 50-29-3 | 0.709 | 21 {1} | 0.59 - 128 | 0.001 | |
| 4,4'-Dichlorobenzophenone | 90-98-2 | | | | | |
| 4-bromophenylphenylether | 101-55-3 | | | | | |
| 4-Nonylphenol, branched | 84852-15-3 | | | | 5 | |
| Acenaphthene | 83-32-9 | | {1} | | 23 | |
| Acenaphthylene | 208-96-8 | | | | 298 | |
| Aldrin | 309-00-2 | 0.1 | 3 {2} | 0.1 – 1.64 | 0.02 | |
| Alpha-Benzene Hexachloride | 319-84-6 | 0.5 | 5 | 0.5 - 655 | 65 | |
| Anthracene | 120-12-7 | 0.67 | 6 | 0.67 – 33.6 | 154 | |
| Antimony | 7440-36-0 | | | | 39568 | |
| Arsenic | 7440-38-2 | 0.97 | 18 {5} | 0.22 – 225 | 2600 | |
| Benzo(a)anthracene | 56-55-3 | 1.5 | 1 | 1.5 | 0.03 | |
| Benzo(a)pyrene | 50-32-8 | 0.922 | 23 {2} | 0.00005 - 100 | 0.01 | |
| Benzo(b)fluoranthene | 205-99-2 | | | | 6 | |
| Benzo(e)pyrene | 192-97-2 | | | | 6 | |
| Benzo(g,h,i)perylene | 191-24-2 | | | | 2 | |
| Benzo(k)fluoranthene | 207-08-9 | | | | 6 | |
| Biphenyl | 92-52-4 | | {1} | | | |
| Bis(2-ethylhexyl) phthalate | 117-81-7 | | | | 32 | |

| Chemical | CAS | ERED/URS | | | FCV | |
|---|---|---|---|---|---|---|
| | | LOED Screening Value (mg/kg ww) | # Data Points (1) | Range of Data | (ug/L) (2) | Qualifier (3) |
| Bromoxynil | 1689-84-5 | | | | 67 | |
| Butyl benzyl phthalate | 85-68-7 | | | | 19 | |
| C1-Chrysenes/Benzo(a)anthracene | # | | | | | |
| C1-dibenz(a,h)anthracene | # | | | | | |
| C1-fluoranthene/pyrene | # | | | | | |
| C1-fluorenes | # | | | | | |
| C1-Naphthalenes | # | | | | | |
| C1-phenanthrene/anthracene | # | | | | | |
| C2-Chrysenes/Benzo(a)anthracene | # | | | | | |
| C2-dibenz(a,h)anthracene | # | | | | | |
| C2-fluorenes | # | | | | | |
| C2-Naphthalenes | # | | | | | |
| C2-phenanthrene/anthracene | # | | | | | |
| C3-Chrysenes/Benzo(a)anthracene | # | | | | | |
| C3-dibenz(a,h)anthracene | # | | | | | |
| C3-fluorenes | # | | | | | |
| C3-Naphthalenes | # | | | | | |
| C3-phenanthrene/anthracene | # | | | | | |
| C4-Chrysenes/Benzo(a)anthracene | # | | | | | |
| C4-Naphthalenes | # | | | | | |
| C4-phenanthrene/anthracene | # | | | | | |
| Cadmium | 7440-43-9 | 0.118 | 129 {13} | 0.005 – 50400 | 1.43 | |
| Chlordane | 57-74-9 | 0.02 | 12 {2} | 0.01 - 281 | 0.004 | |
| Chlorpyrifos | 2921-88-2 | 0.21 | 34 {2} | 0.038 - 770 | 0.01 | |
| Chromium | 7440-47-3 | 0.87 | 7 {7} | 0.87 - 11 | 10.98 | |
| Chromium IV | # | | {5} | | | |
| Chrysene | 218-01-9 | 30 | 1 | 30 | 19 | |
| Copper | 7440-50-8 | 3.1 | 91 {9} | 2.22 - 2500 | 5.16 | |
| Dacthal | 1861-32-1 | | | | 223 | |
| Diazinon | 333-41-5 | 211 | 3 {3} | 211 - 1064 | 0.22 | |
| Dibenz(a,h)anthracene | 53-70-3 | | | | 2 | |
| Dibenzothiophene | 132-65-0 | | {1} | | | |
| Dicamba | 1918-00-9 | | | | | |
| Dichlobanil | 1194-65-6 | | | | 400 | |
| Dieldrin | 60-57-1 | 0.08 | 18 {4} | 0.054 - 1550 | 0.06 | |
| Dimethyl phthalate | 131-11-3 | | | | 33000 | A |
| Di-n-butyl phthalate | 84-74-2 | 32000 | 1 | 32000 | 33 | |
| Di-n-octyl phthalate | 117-84-0 | | | | 0.09 | |

| Chemical | CAS | ERED/URS | | | FCV | |
|---|---|---|---|---|---|---|
| | | LOED Screening Value (mg/kg ww) | # Data Points (1) | Range of Data | (ug/L) (2) | Qualifier (3) |
| Diuron | 330-54-1 | | | | 160 | A |
| Endosulfan | 115-29-7 | 0.031 | 6 | 0.031 – 1.1 | 0.01 | |
| Endosulfan sulfate | 1031-07-8 | | | | 386 | |
| Endrin | 72-20-8 | 0.019 | 33 {4} | 0.01 - 741 | 0.01 | |
| Ethion | 563-12-2 | | | | 0.06 | A |
| Ethoxylated nonylphenol phosphate | 51811-79-1 | | | | | |
| Ethylbenzene | 100-41-4 | | | | 10200 | A |
| Fenitrothion | 122-14-5 | | | | 800 | |
| Fluoranthene | 206-44-0 | 1.15 | 17 {3} | 0.112 - 1011 | 8.10 | |
| Fluorene | 86-73-7 | 6.6 | 4 | 6.6 - 23 | 3.90 | |
| Gamma-Benzene Hexachloride | 58-89-9 | 0.0136 | 8 {6} | 0.0136 - 1246 | 0.08 | |
| Guthion | 86-50-0 | | | | 0.01 | |
| Heptachlor | 76-44-8 | 0.021 | 8 {2} | 0.021 – 211 | 0.004 | |
| Heptachlor epoxide | 1024-57-3 | 0.01 | 5 {2} | 0.01 – 4.2 | 0.004 | |
| Heptachloronaphthalene | 32241-08-0 | | | | 0.40 | |
| Hexachlorobenzene | 118-74-1 | 0.34 | 2 | 0.34 – 18.81 | 16 | |
| Hexachlorobutadiene | 87-68-3 | 17.8 | 7 | 17.8 – 800 | 90 | A |
| Hexachloroethane | 67-72-1 | | | | 12 | |
| Hexachloronaphthalene | 1335-87-1 | | | | 1.32 | |
| Indeno(1,2,3-c,d)pyrene | 193-39-5 | | | | 2 | |
| Kelthane | 115-32-2 | | | | 16 | |
| Lead | 7439-92-1 | 0.451 | 41 {8} | 0.29 - 6356 | 2.50 | |
| Mercury | 7439-97-6 | 0.27 | 108 {8} | 0.039 - 140 | 0.91 | |
| Methoxychlor | 72-43-5 | 0.3 | 19 | 0.15 - 28 | 0.03 | |
| Methyl parathion | 298-00-0 | | | | 0.03 | |
| Methyltin trichloride | 993-16-8 | | | | 78 | |
| Mirex | 2385-85-5 | 0.02 | 21 {2} | 0.015 - 63 | 1010 | A |
| Naphthalene | 91-20-3 | 1.8 | 8 {1} | 1.8 - 1025 | 24 | |
| Nickel | 7440-02-0 | 15 | 5 {2} | 15 - 118 | 29.02 | |
| N-nitroso diphenylamine | 86-30-6 | | | | 696 | |
| Nonylphenol | 25154-52-3 | | | | 100 | |
| Octachloronaphthalene | 2234-13-1 | | | | 0.12 | |
| Oxadiazon | 19666-30-9 | | | | | |
| Parathion | 56-38-2 | 0.0000227 | 15 {2} | 0.0000167 - 119 | 0.01 | |
| pentabromodiphenyl ether | 32534-81-9 | | | | | |
| Pentachloroanisole | 1825-21-4 | | | | | |
| Pentachloronaphthalene | 1321-64-8 | | | | 4 | |
| Pentachlorophenol | 87-86-5 | 2.34 | 32 {9} | 0.498 - 927 | 4.05 | |

| Chemical | CAS | ERED/URS | | | FCV | |
|---|---|---|---|---|---|---|
| | | LOED Screening Value (mg/kg ww) | # Data Points (1) | Range of Data | (ug/L) (2) | Qualifier (3) |
| Perylene | 198-55-0 | | | | 6 | |
| Phenanthrene | 85-01-8 | 0.78 | 7 {1} | 0.78 - 476 | 6.30 | |
| Phenol | 108-95-2 | 1.8 | 5 {6} | 1.8 – 960 | 157 | |
| Polybrominated terphenyls | # | | | | | |
| Polychlorinated alkenes | # | | | | | |
| Polychlorinated Biphenyls | 1336-36-3 | 0.15 | 91 {16} | 0.04 - 1100 | 0.01 | |
| Polychlorinated Terphenyls | 61788-33-8 | | | | | |
| Polychlorodibenzodioxins | # | | | | | |
| Polychlorodibenzofurans | # | | | | | |
| Pronamide | 23950-58-5 | | | | 1053 | |
| Pyrene | 129-00-0 | 0.01 | 8 {2} | 0.01 - 566 | 55 | |
| Selenium | 7782-49-2 | 0.52 | 53 {2} | 0.23 – 42 | 5 | |
| Silver | 7440-22-4 | 0.33 | 24 | 0.06 - 2510 | | |
| Tetrachloroethene | 127-18-4 | 2189 | 1 | 2189 | 120 | |
| Tetrachloronaphthalene | 1335-88-2 | | | | 14 | |
| Tetradifon | 116-29-0 | | | | | |
| Tetraethyltin | 597-64-8 | | | | 23 | |
| Total benzofluoranthenes (b+k (+j)) | # | | | | | |
| Total pp,-DDT,-DDD,-DDE | # | | | | | |
| Toxaphene | 8001-35-2 | 0.4 | 23 | 0.36 - 52 | 0.0002 | |
| Tributyltin | 688-73-3 | 0.013 | 37 | 0.01 - 202 | 0.02 | |
| Trichloroethene | 79-01-6 | 775 | 1 | 775 | 2000 | A |
| Trichloronaphthalene | 1321-65-9 | | | | 44 | |
| Trifluralin | 1582-09-8 | | | | 3 | |
| Triphenyltin chloride | 639-58-7 | | | | 0.92 | |
| Zinc | 7440-66-6 | 27.8 | 37 {5} | 22.6 - 6400 | 66.60 | |
| | | | | | | |
| | | | | | | |

(1) First value indicates the number of LOED residue-effect values used to derive the 5th %ile and range concentrations.

The value in { } indicates the number of LC50 residue-effect values that are available for a particular chemical.

(2) A Final Chronic Value is generally the 5th percentile LC or EC-50 value from a data set involving water-only, long-term exposure to 3 or more taxa.

Alternatively, if this data is not available, an FCV is estimated by applying an acute-chronic ratio to the 5th percentile LC/EC50 from the acute exposure data set for a particular chemical.

(3) "A" indicates lowest acute data point (from EPA's AQUIRE database) used because no FCV available.