State of Oregon Department of Environmental Quality

Human Health Criteria Issue Paper

Toxics Rulemaking

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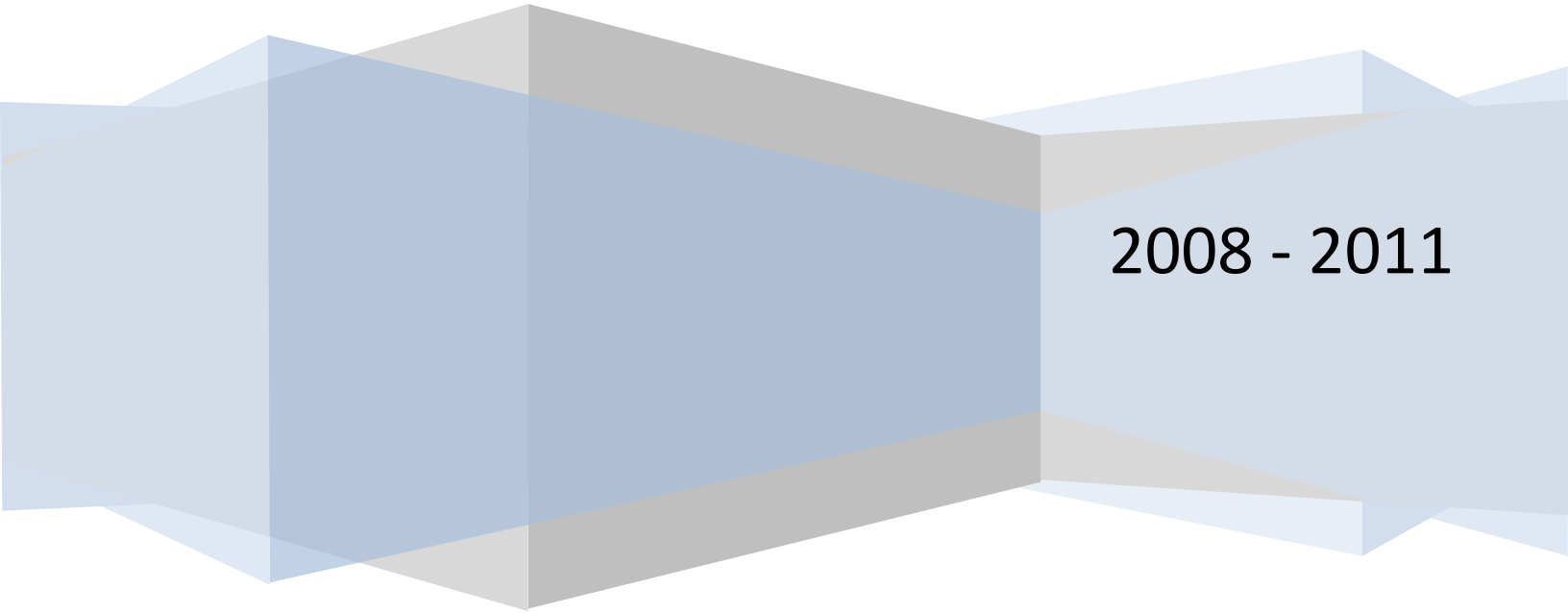

2008 - 2011

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A. Introduction

Purpose of this issue paper

DEQ's currently effective human health toxics criteria are based on a fish consumption rate (FCR) that does not adequately protect Oregonians based on the amount of fish and shellfish they are known to consume. On June 1, 2010, EPA disapproved Oregon's human health toxics criteria that were submitted for approval in 2004 and were based on a fish consumption rate of 17.5 grams per day (g/d). EPA disapproved the human health toxics criteria because the fish consumption rate used to calculate the criteria does not protect Oregonians based on the amount of fish and shellfish they are known to consume. DEQ is addressing EPA's disapproval by proposing to use a higher, more protective fish consumption rate of 175 g/d in its calculation of revised human health toxics criteria. If DEQ does not promulgate revised standards in a timely manner addressing EPA's disapproval, EPA must conduct rulemaking to promulgate human health toxics criteria for Oregon.

This issue paper includes information relevant to DEQ's development of proposed human health toxics criteria based on a higher fish consumption rate. It also describes the human health toxics criteria methodology used to calculate criteria. Proposed changes will affect the criteria values contained in Tables 20, 33A, and 33B, as well as the narrative toxics provision in OAR 340-041-0033 (Toxic Substances).

B. Background

B.1. Brief History of EPA's Recommended Human Health Toxics Criteria

The Clean Water Act requires EPA to publish recommended water quality criteria based upon the most recent science. States typically use these values in developing their own water quality standards regulations. In 1986, EPA published a compilation of these values in the Quality Criteria for Water 1986[1], also known as the "Gold Book." In 1992, EPA promulgated water quality criteria for toxic pollutants for 14 States. These updated criteria became known as the National Toxics Rule[2] and differed substantially from the EPA Gold Book. In 1995, EPA applied the methodology and data used in the Great Lakes Water Quality Initiative[3] to derive new national aquatic life criteria for 15 toxic pollutants in freshwater. In 1999, EPA published the next major update of water quality criteria[4]. In 2000, EPA promulgated water

[1] EPA. Quality Criteria for Water, 1986 (Gold Book). EPA 440/5-86-001

[2] EPA. Federal Register, Volume: 57, Issue: 246, Page: 60848 (57 FR 60848), Tuesday, December 22, 1992.

[3] EPA. Federal Register, Volume: 60, Number 56, Page: 15365, March 23, 1995.

[4] EPA. National Recommended Water Quality Criteria—Correction. EPA 822-Z-99-001.

quality criteria for toxic pollutants for California known as the California Toxics Rule[5] and also in that same year published a revised methodology[6] for deriving human health criteria. EPA did not publish a summary criteria table to accompany the revised methodology. Since 2000, EPA has updated the human health criteria for some individual compounds as well (e.g. cadmium). In late 2002, EPA published another major update[7] of criteria values using the EPA revised human health methodology, which included more extensive criteria revisions for 15 other toxic pollutants.

B.2. Oregon 2004 Submission of Water Quality Standards

In 1999, DEQ initiated a Water Quality Standards Review (triennial review) to update DEQ toxics criteria based on the 1986 EPA Gold Book (contained in Table 20 of Oregon's water quality standards). This review was completed in 2003. During this review, DEQ made significant revisions to both the aquatic life and human health criteria based on the updated EPA methodologies and science for deriving aquatic life and human health criteria (as described above) that had occurred since the Gold Book had been published. DEQ's criteria that it adopted in 2004 reflected an increase in the fish consumption rate from 6.5 g/d to 17.5 g/d, based on the rate used EPA's national criteria recommendations. However, despite being based on this higher fish consumption rate, some of the 2004 criteria were actually less stringent than Oregon's previous criteria due to updated scientific information affecting other factors that go into calculating human health criteria. To be consistent with the federal requirements, DEQ specified that the criteria that were less stringent than the older Table 20 criteria were not effective for Clean Water Act purposes until after EPA approval.

The Environmental Quality Commission (commission) adopted these new and revised water quality standards on May 20, 2004. Upon adoption, DEQ submitted these criteria changes along with revisions to the narrative toxics provision to EPA on July 8, 2004.

EPA did not act on these revised water quality standards, and a lawsuit was filed on April 7, 2006 noting EPA's failure to act on Oregon's revised human health water quality criteria among other revisions. On May 29, 2008, a U.S. District Court in the District of Oregon issued a consent decree setting forth deadlines by which EPA must take action on Oregon's 2004 water quality standards submission, under Section 303(c) of the CWA (*Northwest Environmental Advocates v. U.S. EPA,* No. 06-479-HA (D. Or. 2006)). The court subsequently issued several extensions of the applicable deadlines for action. The consent decree's applicable deadline for EPA action on the human health criteria was ultimately extended to June 1, 2010.

[5] EPA. Water Quality Standards; Establishment of Numeric Criteria for Priority Toxic Pollutants for the State of California. Federal Register, Volume: 65, Number 97, Page: 31682, May 18, 2000.
[6] EPA. Methodology for Deriving Ambient Water Quality Criteria for the Protection of Human Health (2000). EPA-822-B-00-004, October 2000.
[7] EPA. Revision of National Recommended Water Quality Criteria. Federal Register, Volume: 67, Number 249, Page 79091-79095, December 27, 2002.

B.3. EPA Action on Oregon's 2004 Submission of Human Health Toxics Criteria

B.3.1. Disapproved Human Health Criteria

On June 1, 2010, EPA concluded that human health criteria based on a fish consumption rate of 17.5 g/d were not protective of Oregon's designated use of fishing, and thus, did not protect Oregonians who consume higher levels of fish. Consequently, EPA disapproved the majority of the human health criteria that were based on 17.5 g/d (i.e. 48 non-carcinogens and 55 carcinogens). Accompanying footnotes to the disapproved criteria were subsequently disapproved as well. For specific details on EPA's actions, refer to EPA's Technical Support Document[8] accompanying its action.

Oregon's water quality standards included a provision specifying that if a value in Table 33A was disapproved by EPA, the corresponding value in Table 20 would become effective immediately. Values that were the same in Tables 20 and 33A would remain in effect. Consequently, as a result of EPA's disapproval, DEQ's human health toxics criteria reverted back to Table 20 values which are largely based on a fish consumption rate of 6.5 g/d. The few exceptions where EPA did approve criteria from DEQ's 2004 adoption are noted below in the "Approved Human Health Criteria" section.

Under CWA Section 303(c)(3) and EPA's regulations at 40 CFR Parts 131.21 and 131.22, if EPA disapproves a state's new or revised water quality standards, it must "specify the changes" necessary to meet the applicable requirements of the Act and EPA's regulations. If the state does not adopt necessary changes, EPA must propose and promulgate appropriate changes. In the EPA letter[9] disapproving DEQ's 2004 submission, EPA indicated that revising the human health toxics criteria based on a higher fish consumption rate of 175 g/d will address the EPA's disapproval. This rate represents the value that DEQ recommended to the commissioners at the October 23, 2008 Environmental Quality Commission meeting and that they subsequently directed DEQ to use in its revisions. For more information on DEQ's recommended fish consumption rate, see section C.

B.3.2. Approved Human Health Criteria

The human health criteria identified in this section that EPA approved on June 1, 2010, will be included in the new Table 40 along with the proposed human health criteria.

1. **Human health criteria for copper and asbestos**

   Copper

   The "water + organism" criterion of 1300 ug/L is consistent with EPA's 304(a) recommendation and was therefore approved by EPA. Since human health risks from copper are primarily from

[8] EPA. Technical Support Document for Action on the State of Oregon's New and Revised Human Health Water Quality Criteria for Toxics and Revisions to Narrative Toxics Provisions Submitted on July 8, 2004. June 1, 2010.
[9] EPA. Mike Bussell, EPA Region 10 Division Director to Neil Mullane, DEQ Water Quality Division Administrator. EPA's Action on New and Revised Human Health Water Quality Criteria for Toxics and Revisions to Narrative Toxics Provisions in Oregon's Water Quality Standards. June 1, 2010

drinking water and not fish consumption, the lower fish consumption rate of 17.5 g/d was not relevant to EPA's decision.

Asbestos
The "water + organism" criterion of 7,000,000 fibers/L is consistent with EPA's 304(a) recommendation and was therefore approved by EPA. Since human health risks from copper are primarily from drinking water and not fish consumption, the lower fish consumption rate of 17.5 g/d was not relevant to EPA's decision.

2. Footnote K insofar as it applies to the "water + organism" human health criteria for iron and manganese

Footnote K states: "Human Health criterion is for "dissolved" concentration based on the 1976 EPA Red Book conclusion that adverse effects from exposure at this level are aesthetic rather than toxic." EPA approved this footnote for the "water + organism" criteria for both iron and manganese, but disapproved the footnote for the manganese "organism only" criterion because EPA could not ensure the protectiveness of using the dissolved form of manganese. In a separate rulemaking for manganese, DEQ therefore, expressed the criterion as an "organism only" total manganese criterion for marine waters. The criterion is based on human health toxicity endpoints related to the consumption of marine mollusks.

In same rulemaking, DEQ withdrew the "water + organism" iron and manganese human health criteria and the "organism only" manganese criterion for fresh waters. The criteria were not based on levels needed to protect human health. Rather, the primary effects considered were aesthetic (e.g., taste and laundry staining). Iron and manganese are a naturally occurring earth metals that sometimes exceeded the previous criteria due to natural background levels.

The Environmental Quality Commission adopted the revisions to the iron and manganese criteria on December 9, 2010. The revisions are reflected in the new Table 40 and will become applicable upon EPA approval.

3. Withdrawal of the human health criteria for eight toxic pollutants

Consistent with EPA's action under the National Toxics Rule, Oregon withdrew its human health criteria for the following toxic pollutants and was approved by EPA:

- Beryllium
- Cadmium
- Chromium III
- Chromium VI
- Lead
- Mercury
- Silver

- Trichloroethane 1, 1, 1

4. Revisions to the narrative toxic provisions at OAR 340-041-0033(1) and (2).

Revisions to OAR 340-041-0033(1) were approved by EPA as minor editorial changes. Revisions to (2) describe effective dates for human health and aquatic life toxics criteria in Tables 20, 33A and 33B.

B.4. Applicability of EPA's June 2010 Action to 2011 Proposed Human Health Criteria Revisions

In the current effort to develop the human health criteria proposed revisions, DEQ generally relied on the scientific information, policy decisions, and subsequent recommendations from the 1999 triennial review and 2004 submission as the basis for these human health criteria revisions. The major difference between criteria that were submitted in 2004 and the proposed 2011 criteria is the fish consumption rate (i.e. 175 g/d versus 17.5 g/d). In addition, DEQ is not proposing any revisions to the aquatic life criteria. These criteria were adopted and submitted to EPA in 2004 and are still undergoing Endangered Species Act consultation by EPA, the U.S. Fish and Wildlife Service, and NOAA's National Marine Fisheries Service and are not the subject of this review.

C. Development of a Fish Consumption Rate

C.1. Background

DEQ's water quality standards play an important role in maintaining and restoring the environmental quality and quality of life that Oregonians value. Human health criteria are used to limit the amount of toxic pollutants that enter Oregon's waterways and accumulate in the fish and shellfish consumed by many Oregonians as a traditional and/or healthful lifestyle. Human health criteria help to ensure that people may eat fish and shellfish (from here forward referred to as "fish") from local waters without incurring unacceptable health risks.

In 2004, the commission, at DEQ's recommendation, adopted water quality criteria based on EPA's 2002 recommended toxic pollutants criteria for aquatic life and for human health. The human health criteria were based on a fish consumption rate of 17.5 g/d, which represents the 90th percentile of consumption among consumers and non-consumers of fish nationwide. Prior to adopting the 2004 revisions, DEQ's human health criteria were based on EPA's 1986 recommended criteria and a fish consumption rate of 6.5 g/d. A fish consumption rate of 17.5 g/d equals about 0.6 ounces per day or three 6-ounce meals per month. Based on concerns that the fish consumption rate used in the EPA criteria may not accurately represent Oregonian's consumption patterns, the commission requested that DEQ seek resources to conduct a fish consumption rates study in Oregon.

Following DEQ's 2004 adoption of EPA's recommended criteria, concerns about Oregon's human health criteria heightened. Native American tribal governments objected to the criteria, stating that the criteria

did not protect tribal members who eat much greater amounts of fish and for whom fish consumption is a critical part of their cultural tradition and religion. Tribes have rights to catch fish in Oregon waters and EPA has a trust responsibility to protect the interests of the tribes. The Oregon tribes who were most involved in the fish consumption rate workshops and discussions and the subsequent rulemaking process include the Umatilla, Warm Springs, Klamath, Siletz and Grand Ronde tribes.

Although DEQ's 2004 human health criteria reflected EPA's guidance contained in the Human Health Methodology including use of 17.5 g/d as a default value, the guidance also recommends using local fish consumption data when it is available. In this circumstance, local data was available from a study conducted by the Columbia River Inter-Tribal Fish Commission [10] or "CRITFC Study", which included surveys of four Columbia River Tribes, two of whom reside in Oregon, the Confederated Tribes of the Umatilla Indian Reservation (CTUIR) and the Confederated Tribes of the Warms Springs Reservation.

C.2. Fish Consumption Rate Review Project

For the above reasons and with the recognition that many Oregonians eat more than 17.5 g/d of fish and shellfish, DEQ embarked on a project to review the fish consumption rate and subsequently revise the human health water quality criteria for Oregon. DEQ was not able to obtain funding for a study of Oregon fish consumption rates, so the review was based on available literature and data.

DEQ launched the fish consumption rate review project in the fall of 2006 and conducted seven workshops in cooperation with the EPA and the Confederated Tribes of the Umatilla Indian Reservation. The objective for these workshops was to allow any member of the public to receive and provide input on the information being gathered and evaluated, and express views on the policy issues inherent in choosing a fish consumption rate.

DEQ also formed two workgroups, the Human Health Focus Group (HHFG), to assist with gathering and evaluating relevant information. The Human Health Focus Group, made up of public health professionals and toxicologists, reviewed the available data on fish consumption patterns in the Pacific Northwest and elsewhere. The group wrote a report[11] summarizing the science and made recommendations about the quality and appropriate use of the available information. DEQ considered the HHFG's analysis in its selection of a fish consumption rate. The report, materials and agendas from the HHFG process, are contained on DEQ's website.

C.3. Choosing an Appropriate Fish Consumption Rate

Oregon's existing human health criteria are based either on a defined acceptable level of cancer risk (1 in 1,000,000 additional incidents of cancer) or a reference dose beyond which effects in test populations begin to be observed. People who eat more fish have a greater probability of incurring a health effect

[10] Columbia River Inter-Tribal Fish Commission. October 1994. A Fish Consumption Survey of the Umatilla, Nez Perce, Yakama, and Warm Springs Tribes of the Columbia River Basin. Technical Report 94.3.
[11] Human Health Focus Group Report. Oregon Fish and Shellfish Consumption Rate Project. June 2008.

from this exposure to contaminants and those who eat less fish will have less risk. As the fish consumption rate increases, the water quality criteria values will decrease and the costs to meet requirements associated with the revised criteria may rise. How much the criterion for any given pollutant will change with a change in the fish consumption rate also depends on the degree to which that pollutant accumulates in fish tissue. Therefore, a ten-fold increase in the fish consumption rate will not necessarily result in a ten-fold decrease for all criteria; the change in the criteria will vary by pollutant.

A major policy decision inherent in developing human health criteria is whether to base the criteria on a fish consumption rate that includes Oregonians who eat large amounts of fish and shellfish for cultural, economic, health or other reasons, or whether to use a fish consumption rate reflective of Oregon's total population, including people who do not eat fish or eat it rarely. A related decision is what proportion or percentile of the population(s) to base the fish consumption rate on. Within any group, whether Native-Americans, Asian-Americans or commercial fishermen, there will be some individuals who eat more than any chosen rate and some who eat less than that rate.

An additional issue discussed during this process was whether to include salmon (an anadromous fish) and/or marine fish in the consumption rate. The Human Health Focus Group recommended that DEQ include salmon and marine fish in the fish consumption rate because these fish are an important part of the fish diet in the Northwest and represent a potential source of exposure to contaminants. In addition, they found that for non-carcinogens, given the status of the relative source contribution (RSC) approach and values, it would be more accurate to account for the consumption of marine fish in the consumption rate than to use the RSCs in deriving criteria for non-carcinogens. Counter arguments to including (or fully counting) salmon and marine fish in the fish consumption rate assert that these fish accumulate most of their contaminant body burden in ocean waters, outside the influence of Oregon's water quality standards and pollution controls. In addition, salmon tend to contain lower levels of contaminants than resident fish. DEQ ultimately recommended that salmon be included in the rate given the large number of Oregonians who traditionally consume large amounts of salmon and noted that they represent a potential path of exposure to toxic pollutants. Consequently, the recommended rate reflects consumption of salmon and lamprey relative to rates documented in the CRITFC study (to protect at least 95% of fish consumers in Oregon), as well as marine fish and shellfish relative to the rates documented in the Puget Sound studies (to protect at least 90% of fish consumers in Oregon).

C.4. DEQ Recommendation on Selecting a Fish Consumption Rate

DEQ determined that a fish consumption rate of 175 g/d is a reasonable and protective fish consumption rate to use as the basis for Oregon's human health criteria. A fish consumption rate of 175 g/d equals approximately 6.2 ounces per day (or approximately 23 8-oz fish or shellfish meals per month). This rate represents the 95th percentile value from the Columbia River Inter-Tribal Fish Commission study and is within the range of the 90th percentile values from various studies from the Northwest assembled by the HHFG. The 175 g/d rate is consistent with the HHFG recommendation to use 90th or 95th percentile values to represent the proportion of the population the criteria should be

designed to protect. It is also consistent with HHFG recommendations to use a fish consumption rate that represents fish consumers only, rather than a rate derived from the overall population including both consumers and non-consumers of fish, and to include salmon and other marine species in the rate.

Another question raised during the 2004 water quality standards review was whether Oregon should use different fish consumption rates for basins or water bodies that reflect consumption patterns in those areas. Although the Technical Advisory Committee proposed applying different consumption rates for different geographic areas within the state, DEQ did not recommend this option based on the following considerations:

- While there is data only for the Umatilla and Warm Springs Tribes in Oregon, studies from the Pacific Northwest and elsewhere show that many Tribes and other groups (e.g. Asian Americans) eat moderate to large amounts of fish. Input at public workshops indicates that there may be other groups that eat large amounts of fish as well, such as commercial or sport fishermen.
- Nearly all the major river basins in Oregon are usual and accustomed fishing areas for an Oregon Tribe.
- People may catch fish in many locations around the state, not just in the river basin in which they live.
- Having different criteria in different basins would create complexities in the regulations and their implementation.

The EPA, CTUIR, and DEQ collaborated on this project throughout the process and issued a joint recommendation[12] to the Environmental Quality Commission on October 23, 2008, to revise Oregon's toxics criteria for human health based on a FCR of 175 g/d. The commission agreed with this recommendation and directed DEQ to proceed with this fish consumption rate as a basis for revising human health criteria.

D. New and Revised Human Health Water Quality Criteria

D.1. Technical Review Process for 2004 Submission

During the development of the 2004 water quality standards revisions, the Technical Advisory Committee (TAC) reviewed EPA's 2000 Methodology in comparison to the 1980 methodology used to derive Table 20 toxics criteria.

The formulae in the 2000 EPA Methodology used to calculate the criteria values differed from those in the 1980 EPA methodology by:

[12] DEQ. October 6, 2008 Memo from Dick Peterson, Director DEQ, to the Environmental Quality Commission. Agenda Item G, Action Item: Oregon's Fish Consumption Rate – For Use in Setting Water Quality Standards for Toxic Pollutants October 23, 2008 commission Meeting.

1) the addition of a new formula to calculate criteria for compounds where the mode of carcinogenicity shows a non-linear relationship between dose and effect;
2) the use of a bioaccumulation factor rather than bioconcentration factor (bioconcentration refers to the uptake and retention of a chemical from the water only; bioaccumulation refers to the uptake and retention of a chemical from all the surrounding environment, e.g. water, food, and sediment); and
3) the use of a new fish consumption rate.

Unless otherwise specified, DEQ relied on the review and decisions made during the development of the 2004 water quality standards to form the technical basis of revising criteria for this rulemaking. The major difference is the use of a higher fish consumption rate of 175 g/d.

D.2. Applicability of "water + organism" and "organism only" Criteria

The criteria calculations for both carcinogens and non-carcinogens differ depending upon the exposure scenario for which the criteria are derived. Oregon's criteria were developed to protect human health from long term exposure to toxic pollutants in drinking water and through eating fish and shellfish contaminated with toxics. The "water + organism" criteria refer to values that if met, ensure exposure through the consumption of drinking water and fish, including shellfish does not result in adverse health effects. The "organism only" criteria refer to values that if met, ensure exposure through the consumption of fish and shellfish only does not result in adverse health effects. These criteria apply where Oregon has designated waters as either a public or private domestic water supply, or as a fishing beneficial use. Generally, the majority of Oregon's waterbodies have been designated as both a domestic or private domestic water supply and as a fishing beneficial use. Therefore, human health toxics criteria will be widely applicable across the state. Table 1 indicates where the "organism only" criteria are the only human health criteria applicable, since a drinking water use has not been designated in these waters (e.g. non-potable estuarine waters).

TABLE 1: Waters Where "Organism Only" Criteria are Solely Applicable: Waters designated as having a fishing use, but not a domestic or private water supply

Table Reference Number	Basin	Segment Name
140A	Goose and Summer Lakes Basin	Goose Lake; and Highly Alkaline and Saline Lakes
190A	Malheur Lake Basin	Natural Lakes
220A	Mid Coast Basin	Estuaries and Adjacent Marine Waters
230A	North Coast Basin	Estuaries and Adjacent Marine Waters
271A	Rogue Basin	Rogue River Estuary and Adjacent Marine Waters; and Bear Creek Main Stem
286A	Sandy Basin	Streams Forming Waterfalls Near Columbia River Highway
300A	South Coast Basin	Estuaries and Adjacent Marine Waters
320A	Umpqua Basin	Umpqua River Estuary to Head of Tidewater and Adjacent Marine Waters

D.3. Criteria Derivation

The methodology for calculating human health toxics criteria takes into consideration three major factors: risk assessment, exposure, and to what degree the pollutant accumulates in fish tissue. Risk assessment includes the potency of the compound to cause a toxic effect that is either cancerous or noncancerous, and for cancer causing compounds, the level of risk that is acceptable for society (e.g. one additional cancer per million people). Exposure includes consideration of body weight, water intake, and fish intake. Bioconcentration is the degree to which an organism accumulates the contaminant from water only, while bioaccumulation describes the net accumulation of a contaminant from all sources.

D.3.1. Non-Carcinogens

DEQ utilized the 2000 Methodology to derive ambient water quality criteria for pollutants. This section describes how DEQ used the methodology as it applies to non-carcinogens.

Equation for Non-Carcinogens:

$$AWQC = RfD \times RSC \times \frac{(BW)}{[DI + (FCR \times BAF)]}$$

where:

AWQC = Ambient Water Quality Criterion (mg/L)

RfD = Reference dose for noncancer effects (mg/kg-day)

RSC = Relative source contribution factor to account for non-water sources of exposure

BW = Human body weight (kg) =70 kg

DI = Drinking water intake (L/day) = 2 L/day

FCR = Fish consumption rate (kg/d) = 175 g/d

BAF = Bioaccumulation factor (L/kg)

Body Weight and Drinking Water Intake

DEQ used EPA's national default values for body weight (70 kilograms or 154 lbs) and drinking water intake (2 L/day). DEQ also relied on EPA's reference doses used as part of its nationally recommended criteria[13]. A reference dose is defined[14] as an estimate (with uncertainty spanning approximately an order of magnitude) of a daily exposure to the human population (including sensitive subgroups) that is likely to be without appreciable risk of deleterious effects over a lifetime.

[13] EPA. 2002. Nationally Recommended Water Quality Criteria 2002 – Human Health Criteria Calculation Matrix. USEPA, Office of Water, Washington, DC. EPA 822-R-02012.

[14] EPA. 1993. Reference Dose (RfD): Description and Use in Health Risk Assessments. Integrated Risk Information System (IRIS). Intra-Agency Reference Dose (RfD) Work Group, Office of Health and Environmental Assessment, Environmental Criteria and Assessment Office, USEPA, Cincinnati, OH.

Bioconcentration Factors (BCF) Versus Bioaccumulation Factors (BAF)

Water quality criteria for the protection of human health are derived, in part, by considering human exposure to pollutants that have been stored within fish after that fish has been exposed to a toxic pollutant. A BCF accounts for the uptake of a pollutant by a fish from the surrounding water, while a BAF accounts for the uptake of a pollutant from all sources (including the surrounding water, food, and sediment). While the consideration of a BAF in EPA's 2000 Methodology was considered an improvement over BCFs, developing BAFs is a complex process and can vary from site to site. EPA has not yet developed a national list of BAFs for its nationally recommended criteria. Consequently, EPA recommends criteria be developed using BCFs until such time local or regional BAFs that would be applicable to Oregon are developed. As a result, proposed criteria for this rulemaking reflect EPA recommended BCF values.

Reference Dose (RfD)

A reference dose is an estimate (with uncertainty spanning approximately an order of magnitude) of a daily exposure to the human population (including sensitive subgroups) that is likely to be without appreciable risk of deleterious effects over a lifetime[15]. Proposed criteria for this rulemaking reflect EPA recommended RfD values. Reference Dose values are based on real studies that reflect health effects from these pollutants at specific levels.

Relative Source Contribution

Criteria for pollutants that are non-carcinogens are based on a total cumulative dose over time that causes an observable effect. Because the human health water quality criteria address exposure only through drinking water and eating fish, a relative source contribution (RSC) factor is used to calculate the criteria. The RSC identifies or estimates the portion of total exposure attributed to water and fish consumption, and therefore, accounts for potential exposure from other sources, such as skin absorption, inhalation, other foods and occupational exposures. The RSC value is either multiplied by the reference dose or subtracted from the reference dose, depending on the chemical and known exposure sources of contaminants. Table 2 identifies the pollutants for which DEQ applied RSC values to the revised human health water quality criteria. For all of the pollutants but Endrin, DEQ used EPA's recommended RSC value. The other non-carcinogen pollutants used a RSC of 1, which indicates that all of the exposure to that pollutant is assumed to come from water and fish ingestion. In some cases, EPA does not have enough data to establish RSC values for other chemicals.

TABLE 2: Criteria Where Relative Source Contribution Values Were Applied

1) Antimony (40%)	9) Thallium (20%)
2) Chlorobenzene (20%)	10) Toluene (20%)
3) Chlorodibromomethane (80%)	11) 1,1,2-Trichloroethane (20%)

[15] EPA. Reference dose (RfD): Description and use in health risk assessments. Integrated Risk Information System (IRIS). Online. Intra-Agency Reference Dose (RfD) Work Group, Office of Health and Environmental Assessment, Environmental Criteria and Assessment Office. Cincinnati, OH. March 15, 1993.

4) Cyanide (20%)	12) 1,1-Dichloroethylene (20%)
5) Endrin (80%)	13) 1,2,4-Trichlorobenzene (20%)
6) Ethylbenzene (20%)	14) 1,2-Dichlorobenzene(o) (20%)
7) gamma-BHC (Lindane) (20%)	15) 1,2-trans-Dichloroethylene (20%)
8) Hexachlorocyclopentadiene (20%)	16) 1,4-Dichlorobenzene(p) (20%)

RSC for Methylmercury

EPA established a RSC value that is subtracted from the reference dose to derive the tissue based methyl mercury criterion. EPA's recommended criterion uses a RSC because EPA's national default fish consumption rate does not include the consumption of marine species of fish (including Pacific salmon), which are a significant potential exposure route for methylmercury. Because the primary human route of exposure to methylmercury comes from ingestion of fish and shellfish, and because DEQ included marine species in the development of its fish consumption rate, it would be "double counting" the exposure if DEQ incorporated the same RSC value used in EPA's recommended methylmercury criterion. Methylmercury is unique in that it is a fish tissue criterion and the primary route of exposure to humans is through the consumption of fish and shellfish. The other criteria where RSC values have been established have other contributing sources of pollutant (e.g., consumption of food or other exposure routes), so removing the RSC would not be appropriate in those circumstances.

RSC for Endrin

EPA used a default RSC value of 20% for Endrin based on a recommendation from EPA's drinking water program. DEQ's final proposed criteria for Endrin use a RSC value of 80%. The primary reason DEQ proposes using an alternate default value is because DEQ does not anticipate exposure to this chemical outside of water and fish ingestion. This is consistent with EPA guidance for use of default RSC values:

> Default RSC Percentage Values: Floor of 20%, Ceiling of 80% (65 FR 66472)
> - EPA has recommended using the 20% RSC default when routes of water exposures other than oral or sources of exposure other than fish and water are anticipated, but adequate data are lacking to quantify those exposures.
> - Utilize local data to quantify exposures from other routes where available: When data are adequate to quantify exposures to other sources (oral or exposure to fish and water), EPA recommends that they be used instead of the default 20% RSC value.
> - If it can be demonstrated that other sources and routes of exposure are not anticipated for the chemical in question (based on information about its known/anticipated uses and chemical/physical properties), then the 80% ceiling is recommended. This 80% ceiling is a way to provide adequate protection for those who experience exposures (from any or several sources) higher than available data may indicate.

Due to the properties of this chemical and the fact that it has not been in use for about 25 years, it is highly unlikely that people in Oregon would gain only 20% of their exposure to Endrin from water and fish and 80% of their exposure from other sources. Endrin bioconcentrates in aquatic organisms, but is not very soluble in water. The bioconcentration factor used to derive the human health criteria is 3970,

resulting in the same criteria value (when rounded to significant digits) for water + organism and for organism only ingestion.

The following information from the US Department of Health and Human Services Toxicological Profile for Endrin (1996, Chapter 5) supports DEQ's decision to use an RSC of 80% rather than 20% to derive Oregon's water quality criteria:

- The use of Endrin ended in the mid-1980s and "consequently, there are no longer any significant releases of Endrin to the environment in the United States."
- "Information on current levels of Endrin in the environment is limited; however, the available data indicate that concentrations in all environmental media are generally negligible or below levels of concern. "
- "The FDA has concluded that Endrin is no longer present in the environment to the extent that it may be contaminating food or feed at levels of regulatory concern (USDA 1995)."
- Endrin tends to persist in the environment mainly in forms sorbed to sediments and soil particles. A conservative estimate of its half-disappearance time in sandy loam soils is approximately 14 years. "Therefore, the exposure risks from Endrin to the general population of the United States are likely to steadily decrease over time."
- Limited information on the physical and/or chemical properties of Endrin aldehyde indicates that it is highly insoluble in water (EPA 1981a), highly immobile in soil, and will not volatilize significantly from water or soil.
- Endrin has been found to volatilize significantly (20-30%) from soils within days after application (Nash 1983). Because Endrin has not been in use for many years, this exposure route no longer occurs in Oregon.
- The main sources for potential human exposure to Endrin are residues on imported food items, unused stocks, unregistered use, inappropriate disposal, and hazardous waste sites; however, there is no current evidence of significant exposures from any of these sources. Furthermore, it should be noted that in environmental media, especially in contaminated soils and sediments, the amount of Endrin chemically identified by analysis is not necessarily the amount that is toxicologically available.
- Endrin was identified at 102 and Endrin ketone was identified at 37 of 1430 current or former hazardous waste sites in the United States. None of these sites were in Oregon (Figures 5-1 and 5-2).

D.3.2. Carcinogens

DEQ utilized the 2000 Methodology to derive ambient water quality criteria for pollutants that are carcinogens.

Equation for linear dose-response carcinogens:

$$AWQC = \frac{(Risk\ Level \times BW)}{[CSF \times (DI + (FCR \times BAF))]}$$

where:

AWQC = Ambient Water Quality Criterion (mg/L)

Risk Level = Risk Level (unitless)

CSF = Cancer slope factor (mg/kg-day)

BW = Human body weight (kg) =70 kg

DI = Drinking water intake (L/day) = 2 L/day

FCR = Fish consumption rate (kg/d) = 175 g/d

BAF = Bioaccumulation factor (L/kg)

The equation to derive ambient water quality criteria for pollutants that are carcinogens (i.e. cancer-causing pollutants) uses many of the same variables as the equation for non-carcinogens (i.e. body weight, drinking water intake, fish consumption rate, and bioaccumulation factor). The main difference is that a risk level and a cancer slope factor are used, and a relative source concentration is not used.

Cancer Slope Factor and Risk Level

The cancer slope factor is a measure of chemical potency. For most cancer-causing chemicals there is no toxicity threshold or reference dose. Because carcinogenic chemicals are thought to initiate the cancer process at almost any concentration, a dose-response parameter referred to as the cancer slope factor is used for chemicals that display toxic behavior such that the carcinogenic risk increases linearly as the chemical dose increases. Cancer slope factors are specific to individual pollutants. DEQ utilized EPA's nationally recommended slope factors to calculate criteria for carcinogens. Cancer slope factors are based on real studies that reflect health effects from carcinogenic pollutants at specific levels.

Risk estimates for carcinogens are expressed as the incremental probability of developing cancer (e.g., an additional one in one million chance of developing cancer) over a lifetime of exposure to potential carcinogens. EPA has identified a risk level range of 1×10^{-6} (1 in 1,000,000) to 1×10^{-5} (1 in 100,000) to be an appropriate risk management goal for the general population, as long as the most sensitive population is protected at 1×10^{-4} (1 in 10,000). As a matter of policy, DEQ has historically chosen to protect Oregonians at a risk level of 1×10^{-6} and will continue with this recommendation for the proposed human health toxics criteria. As a result, the proposed criteria will protect highly exposed populations in Oregon consuming up to 175 g/d of fish at a risk level of 1×10^{-6}.

D.3.3. Criteria Not Dependent on a Fish Consumption Rate

Although the majority of DEQ's proposed human health criteria are affected by the fish consumption rate, several of Oregon's existing criteria are not based on a fish consumption rate. For these criteria,

human health risks are primarily from drinking water and the existing criteria are based on the Maximum Contaminant Level (MCL) established under the Safe Drinking Water Act. Therefore, DEQ has not developed any "organism only" criteria. As a result, DEQ is not proposing to change the existing human health criteria identified in Table 3.

TABLE 3: Human health toxics criteria not dependent on a fish consumption rate

Asbestos	Methoxychlor
Barium	Nitrates
Chlorophenoxy Herbicide (2,4,5,-TP)	Copper
Chlorophenoxy Herbicide (2,4,-D)	Manganese

D.3.4. Toxics Criteria DEQ is Proposing to Withdraw

The following toxics pollutants have currently effective human health criteria, however, there are no longer EPA criteria for these pollutants. In some cases, like PAHs, the revised criteria include individual species of the more toxic forms of PAH, rather than a single criterion for a chemical family. Therefore, DEQ's proposed final rule withdraws the human health criteria for these pollutants.

TABLE 4: Pollutants for which DEQ Proposes to Withdraw Criteria

Dinitrotoluene
Dinitro-o-Cresol 2,4
Diphenylhydrazine
Halomethanes
Monochlorobenzene
Polynuclear Aromatic Hydrocarbons (PAHs)
Endosulfan

Based on information gathered during the public comment period, DEQ learned it had inadvertently included a "benzene range" as part of Table 40. In addition, DEQ included revisions to the "benzene" criteria that are single values. In investigating the basis for the "benzene range" DEQ identified that EPA does not have any recommended criteria for a "benzene range" and noted that DEQ has no precedent for expressing criteria as a range of values. Further investigations show there is a range of values presented in EPA's IRIS database for the cancer slope factor associated with benzene associated with the use of different modeling methods for the data. The cancer slope factor used for the development of the benzene criteria is consistent with the factor EPA used in deriving the national benzene criterion. Given this information, including both the "benzene range" criteria in addition to the benzene criteria is duplicative. As a result, DEQ removed the benzene range criteria from Table 40.

D.3.5. Proposed Toxics Criteria Additions

DEQ's final proposed rules add criteria for 39 toxic pollutants to the human health criteria table. DEQ included criteria for these pollutants in its 2004 water quality standards based on updated EPA criteria,

but EPA subsequently disapproved those criteria on June 1, 2010, because of an inadequate fish consumption rate. Revised criteria for these pollutants now reflect a fish consumption rate of 175 g/d.

TABLE 5: Pollutants for Which DEQ Proposes to Add Criteria

Acenapthene	Dimethyl phenol 2,4
Anthracene	Dinitrophenol 2,4
Benzene [represents range]	Dinitrophenols
Benz(a)anthracene	Diphenylhydrazine 1,2
Benzo(a)pyrene	Endosulfan alpha
Benzo(b)fluoranthene 3,4	Endosulfan beta
Benzo(k)fluoranthene	Endosulfan sulfate
Bromoform	Endrin aldehyde
Butylbenzyl phthalate	Fluorene
Chlorodibromomethane	Heptachlor epoxide
Chloronaphthalene 2	Indeno(1,2,3-cd)pyrene
Chlorophenol 2	Methyl bromide
Chrysene	Methyl-4,6-dinitrophenol 2
DDD 4, 4'	Methylene chloride
DDE 4, 4'	Methylmercury (mg/kg)
Dibenz(a,h)anthracene	Nitrosodi-n-propylamine, n
Dichlorobenzene(p) 1,4	Pyrene
Dichlorobromomethane	Trichlorobenzene 1,2,4
Dichloroethylene trans 1,2	Zinc
Dichloropropane	

D.3.6. Less Stringent Toxics Criteria

Although the majority of proposed toxics criteria are more stringent than the currently effective values based on a higher fish consumption rate, several of the criteria values became less stringent. As new risk-based data and studies become available, EPA updates risk values (e.g. cancer slopes, reference doses, bioconcentration factors) associated with exposure to environmental contaminants in EPA's IRIS (Integrated Risk Information System) database. DEQ, unless otherwise specified, used EPA's default values in IRIS as the basis for revising criteria. For the pollutants identified in Table 6, changes to values other than the fish consumption rate resulted in proposed criteria that were less stringent than current criteria despite utilizing a higher fish consumption rate.

TABLE 6: Less Stringent Toxics Criteria

Chloroform
Nickel
Phenol
Selenium

E. New, Revised, and Removed Footnotes

DEQ included new or removed footnotes for some human health criteria in Table 40. The majority of these footnotes clarify the source of information upon which the proposed criteria are based. Several of these footnotes with similar language were proposed as part of the 2004 water quality standards submittal, but were subsequently disapproved in conjunction with EPA's disapproval of the associated criteria.

TABLE 7: New Footnotes

Toxic Pollutant	New Footnote
1. Arsenic	This footnote was not included as part of the separate rulemaking for arsenic which was adopted by the EQC on April 21, 2011. A new footnote is now proposed to clarify how arsenic is expressed, as well as the associated risk level the criteria are based upon. *The arsenic criteria are expressed as total inorganic arsenic. The "organism only" criteria are based on a risk level of approximately of 1.1 x 10^{-5}, and the "water + organism" criterion is based on a risk level of 1 x 10^{-4}*
2. Asbestos	*The human health risks from asbestos are primarily from drinking water, therefore no "organism only" criterion was developed. The "water + organism" criterion is based on the Maximum Contaminant Level (MCL) established under the Safe Drinking Water Act.*
3. Barium	*The human health criterion for barium is the same as originally published in the 1976 EPA Red Book which predates the 1980 methodology and did not utilize the fish ingestion BCF approach. This same criterion value was also published in the 1986 EPA Gold Book. Human health risks are primarily from drinking water, therefore no "organism only" criterion was developed. The "water + organism" criterion is based on the Maximum Contaminant Level (MCL) established under the Safe Drinking Water Act.*
4. Chlorophenoxy Herbicide (2,4,5,-TP)	*The Chlorophenoxy Herbicide (2,4,5,-TP) criterion is the same as originally published in the 1976 EPA Red Book which predates the 1980 methodology and did not utilize the fish ingestion BCF approach. This same criterion value was also published in the 1986 EPA Gold Book. Human health risks are primarily from drinking water, therefore no "organism only" criterion was developed. The "water + organism" criterion is based on the Maximum Contaminant Level (MCL) established under the Safe Drinking Water Act.*
5. Chlorophenoxy Herbicide (2,4-D)	*The Chlorophenoxy Herbicide (2,4-D) criterion is the same as originally published in the 1976 EPA Red Book which predates the 1980 methodology and did not utilize the fish ingestion BCF approach. This same criterion value was also*

Toxic Pollutant	New Footnote
	published in the 1986 EPA Gold Book. Human health risks are primarily from drinking water, therefore no "organism only" criterion was developed. The "water + organism" criterion is based on the Maximum Contaminant Level (MCL) established under the Safe Drinking Water Act.
6. Cyanide	*The cyanide criterion is expressed as total cyanide (CN)/L.*
7. Di-2-ethylhexyl Phthalate	*Di-2-ethylhexyl Phthalate was previously known as Bis-2-ethylhexyl phthalate*
8. Methoxychlor	*The human health criterion for methoxychlor is the same as originally published in the 1976 EPA Red Book which predates the 1980 methodology and did not utilize the fish ingestion BCF approach. This same criterion value was also published in the 1986 EPA Gold Book. Human health risks are primarily from drinking water, therefore no "organism only" criterion was developed. The "water + organism" criterion is based on the Maximum Contaminant Level (MCL) established under the Safe Drinking Water Act.*
9. Methylmercury	*This value is expressed as the fish tissue concentration of methylmercury. Contaminated fish and shellfish is the primary human route of exposure to methylmercury*
10. PCBs	*This criterion applies to total PCBs (e.g. determined by Aroclors or congeners)*

TABLE 5: Revised Footnotes

Toxic Pollutant	Current Footnote	Revised Footnote
1. Copper	*This value is based on a Drinking Water regulation.*	*Human health risks from copper are primarily from drinking water, therefore no "organism only" criterion was developed. The "water + organism" criterion is based on the Maximum Contaminant Level (MCL) established under the Safe Drinking Water Act.*

Toxic Pollutant	Current Footnote	Revised Footnote
2. Nitrates	*No BCF was available; therefore, this value is based on that published in the 1986 EPA Gold Book.*	*The human health criterion for nitrates is the same as originally published in the 1976 EPA Red Book which predates the 1980 methodology and did not utilize the fish ingestion BCF approach. This same criterion value was also published in the 1986 EPA Gold Book. Human health risks are primarily from drinking water, therefore no "organism only" criterion was developed. The "water + organism" criterion is based on the Maximum Contaminant Level (MCL) established under the Safe Drinking Water Act.*

TABLE 6: Footnotes Removed

Bioconcentration factors for the three toxic pollutants in Table 6 are now available and were used to calculate criteria. For this reason, DEQ removed the footnotes because they are no longer applicable.

Toxic Pollutant	Current Footnote To Be Removed
1. Hexachlorocyclo-hexane-Technical	*No BCF was available; therefore, this value is based on that published in the 1986 EPA Gold Book.*
2. Nitrosamines	*No BCF was available; therefore, this value is based on that published in the 1986 EPA Gold Book.*
3. N-Nitrosodiethylamine	*No BCF was available; therefore, this value is based on that published in the 1986 EPA Gold Book.*

F. Proposed Redline/Strikethrough Revisions to the Toxic Substances Rule

DEQ proposed several changes to 340-041-0033 in the rules DEQ published for public comment. The proposed revisions addressed the separation of the aquatic life criteria and the human health criteria in different tables. In addition, DEQ proposed a "Background Pollutant Allowance" for public comment.

In the revisions shown below, DEQ reorganized provisions relating to the aquatic life criteria and the human health criteria as separate sections. In addition, DEQ added a new section (1) specifying that the 112 toxics human health criteria revised by this rule are not applicable for purposes of the Clean Water Act until they are approved by EPA. This section also applies to the revised iron, manganese, and arsenic criteria the commission adopted in December 2010 and April 2011, respectively.

The provisions addressing background pollutants (now termed "Site-Specific Background Pollutant Criteria") remain in OAR 340-041-0033(6). These revisions are discussed in the *Implementing Water*

Quality Standards in NPDES Permits issue paper, and therefore, are not included in the revisions shown below.

In April 2011, EQC also adopted the arsenic reduction policy as OAR 340-041-0033(3). To accommodate revisions associated with this rulemaking, DEQ reorganized the rule to move the arsenic reduction policy section further back in this rule to OAR 340-041-0033(7), but did not revise any of the rule as adopted by the commission.

340-041-0033

Toxic Substances

(1) Amendments to sections (4) and (6) of this rule (OAR 340-041-0033) and associated revisions to Tables 20, 33A, 33B and 40 do not become applicable for purposes of ORS chapter 468B or the federal Clean Water Act unless and until they are approved by EPA pursuant to 40 CFR 131.21 (4/27/2000).

(~~1~~2) Toxic substances may not be introduced above natural background levels in waters of the state in amounts, concentrations, or combinations that may be harmful, may chemically change to harmful forms in the environment, or may accumulate in sediments or bioaccumulate in aquatic life or wildlife to levels that adversely affect public health, safety, or welfare or aquatic life, wildlife, or other designated beneficial uses.

(~~2~~3) Aquatic Life Criteria. Levels of toxic substances in waters of the state may not exceed the applicable aquatic life criteria listed in Tables 20, 33A, and 33B. Tables 33A and 33B, adopted on May 20, 2004, update Table 20 as described in this section.

> *(a) Each value for criteria in Table 20 is effective until the corresponding value in Tables 33A or 33B becomes effective.*
>
> > *(A) Each value in Table 33A is effective on February 15, 2005, unless EPA has disapproved the value before that date. If a value is subsequently disapproved, any corresponding value in Table 20 becomes effective immediately. Values that are the same in Tables 20 and 33A remain in effect.*
> >
> > *(B) Each value in Table 33B is effective upon EPA approval.*
>
> *~~(b) The arsenic criteria in Table 20 established by this rule do not become applicable for purposes of ORS chapter 468B or the federal Clean Water Act unless and until they are approved by EPA pursuant to 40 CFR 131.21 (4/27/2000).~~*
>
> *(~~c~~b) The department will note the effective date for each value in Tables 20, 33A, and 33B as described in this section.*

~~(3) To establish permit or other regulatory limits for toxic substances for which criteria are not included in Tables 20, 33A, or 33B, the department may use the guidance values in Table 33C, public health advisories, and other published scientific literature. The department may also require or conduct bio-~~

~~*assessment studies to monitor the toxicity to aquatic life of complex effluents, other suspected discharges, or chemical substances without numeric criteria.*~~

~~*(4) Arsenic Reduction Policy: The inorganic arsenic criterion for the protection of human health from the combined consumption of organisms and drinking water is 2.1 micrograms per liter. While this criterion is protective of human health and more stringent than the federal maximum contaminant level (MCL) for arsenic in drinking water, which is 10 micrograms per liter, it nonetheless is based on a higher risk level than the Commission has used to establish other human health criteria. This higher risk level recognizes that much of the risk is due to naturally high levels of inorganic arsenic in Oregon's waterbodies. In order to maintain the lowest human health risk from inorganic arsenic in drinking water, the Commission has determined that it is appropriate to adopt the following policy to limit the human contribution to that risk.*~~

~~*(a) The arsenic reduction policy established by this rule section does not become applicable for purposes of ORS chapter 468B or the federal Clean Water Act unless and until the numeric arsenic criteria established by this rule are approved by EPA pursuant to 40 CFR 131.21 (4/27/2000).*~~

~~*(b) It is the policy of the Commission that the addition of inorganic arsenic from new or existing anthropogenic sources to waters of the state within a surface water drinking water protection area be reduced the maximum amount feasible. The requirements of this rule section [OAR 340-041-0033(4)] apply to sources that discharge to surface waters of the state with an ambient inorganic arsenic concentration equal to or lower than the applicable numeric inorganic arsenic criteria for the protection of human health.*~~

~~*(c) The following definitions apply to this section [OAR 340-041-0033(4)]:*~~

~~*(A) "Add inorganic arsenic" means to discharge a net mass of inorganic arsenic from a point source (the mass of inorganic arsenic discharged minus the mass of inorganic arsenic taken into the facility from a surface water source).*~~

~~*(B) A "surface water drinking water protection area," for the purpose of this section, means an area delineated as such by DEQ under the source water assessment program of the federal Safe Drinking Water Act, 42 U.S.C. § 300j-13. The areas are delineated for the purpose of protecting public or community drinking water supplies that use surface water sources. These delineations can be found at DEQ's drinking water program website.*~~

~~*(C) "Potential to significantly increase inorganic arsenic concentrations in the public drinking water supply source water" means:*~~

~~*(i) to increase the concentration of inorganic arsenic in the receiving water for a discharge by 10 percent or more after mixing with the harmonic mean flow of the receiving water; or*~~

~~*(ii) as an alternative, if sufficient data are available, the discharge will increase the concentration of inorganic arsenic in the surface water intake water of a public water system by 0.021 micrograms per liter or more based on a mass balance calculation.*~~

(d) Following the effective date of this rule, applications for an individual NPDES permit or permit renewal received from industrial dischargers located in a surface water drinking water protection area and identified by DEQ as likely to add inorganic arsenic to the receiving water must include sufficient data to enable DEQ to determine whether:

(A) The discharge in fact adds inorganic arsenic; and

(B) The discharge has the potential to significantly increase inorganic arsenic concentrations in the public drinking water supply source water.

(e) Where DEQ determines that both conditions in subsection (d) of this section (4) are true, the industrial discharger must develop an inorganic arsenic reduction plan and propose all feasible measures to reduce its inorganic arsenic loading to the receiving water. The proposed plan, including proposed measures, monitoring and reporting requirements, and a schedule for those actions, will be described in the fact sheet and incorporated into the source's NPDES permit after public comment and DEQ review and approval. In developing the plan, the source must:

(A) Identify how much it can minimize its inorganic arsenic discharge through pollution prevention measures, process changes, wastewater treatment, alternative water supply (for groundwater users) or other possible pollution prevention and/or control measures;

(B) Evaluate the costs, feasibility and environmental impacts of the potential inorganic arsenic reduction and control measures;

(C) Estimate the predicted reduction in inorganic arsenic and the reduced human health risk expected to result from the control measures;

(D) Propose specific inorganic arsenic reduction or control measures, if feasible, and an implementation schedule; and

(E) Propose monitoring and reporting requirements to document progress in plan implementation and the inorganic arsenic load reductions.

(f) In order to implement this section, DEQ will develop the following information and guidance within 120 days of the effective date of this rule and periodically update it as warranted by new information:

(A) A list of industrial sources or source categories, including industrial stormwater and sources covered by general permits, that are likely to add inorganic arsenic to surface waters of the State.

(i) For industrial sources or source categories permitted under a general permit that have been identified by DEQ as likely sources of inorganic arsenic, DEQ will evaluate options for reducing inorganic arsenic during permit renewal or evaluation of Stormwater Pollution Control Plans.

(B) Quantitation limits for monitoring inorganic arsenic concentrations.

(C) Information and guidance to assist sources in estimating, pursuant to paragraph (d) (C) of this section, the reduced human health risk expected to result from inorganic arsenic control measures based on the most current EPA risk assessment.

~~*(g) It is the policy of the Commission that landowners engaged in agricultural or development practices on land where pesticides, fertilizers, or soil amendments containing arsenic are currently being or have previously been applied, implement conservation practices to minimize the erosion and runoff of inorganic arsenic to waters of the State or to a location where such material could readily migrate into waters of the State.*~~

(4) Human Health Criteria. The criteria for waters of the state listed in Table 40 are established to protect Oregonians from potential adverse health effects associated with long-term exposure to toxic substances associated with consumption of fish, shellfish, and water.

(3~~5~~5) To establish permit or other regulatory limits for toxic substances for which criteria are not included in Tables 20, 33A, or 33B, the department may use the guidance values in Table 33C, public health advisories, and other published scientific literature. The department may also require or conduct bio-assessment studies to monitor the toxicity to aquatic life of complex effluents, other suspected discharges, or chemical substances without numeric criteria.

(6) Establishing Site-Specific Background Pollutant Criteria: ….

(4~~7~~7) Arsenic Reduction Policy: …

[ED. NOTE: Tables referenced are available from the agency.]

Stat. Auth.: ORS 468.020, 468B.030, 468B.035 & 468B.048
Stats. Implemented: ORS 468B.030, 468B.035 & 468B.048
Hist.: DEQ 17-2003, f. & cert. ef. 12-9-03; DEQ 3-2004, f. & cert. ef. 5-28-04; DEQ 17-2010, f. & cert. ef. 12-21-10

G. Implementation

G.1. Effective Dates

DEQ is proposing that the human health criteria revisions established by OAR 340-041-0033 and shown in Table 40 do not become applicable for purposes of ORS chapter 468B or the federal Clean Water Act until approved by EPA pursuant to 40 CFR 131.21 (4/27/2000).

In contrast, for DEQ's 2004 water quality standards submission, the revised toxics criteria became effective for NPDES purposes nine months following the date of commission adoption. DEQ also specified that if the values were subsequently disapproved after that date, any corresponding value in Table 20 would become effective. EPA disapproved the majority of DEQ's 2004 human health criteria on June 1, 2010, nearly six years after the effective date. As a result, many of the criteria adopted in 2004 that had become effective subsequently reverted back to human health criteria based on a FCR of 6.5 g/day. Given the potential ramifications of criteria becoming effective in advance of EPA's action, DEQ is proposing that the human health criteria only become applicable for CWA programs upon EPA approval, rather than at the time of commission adoption.

G.2. NPDES Compliance

Dischargers will not need to modify existing permits to immediately incorporate new limits or requirements associated with the revised criteria at the time of EPA approval if that approval occurs during their permit cycle. However, at the time of permit renewal, permits will be evaluated and water quality-based effluent limitations (WQBELs) will be developed or revised in the renewed permit, if needed, to meet revised water quality criteria.

G.3. Methylmercury

In January 2001, EPA published a new water quality criterion for methylmercury that, for the first time, expresses a human health criterion as a concentration in fish and shellfish tissue rather than in the water. In 2004, the EQC adopted a tissue-based methylmercury criterion to replace its previous mercury water column criteria, but it was subsequently disapproved by EPA based on a fish consumption rate that was too low (i.e. 17.5 g/day). DEQ's final proposed rules includes a revised methylmercury fish tissue criterion based on a fish consumption rate of 175 g/day. Because the adoption of tissue-based criteria can pose challenges in implementing the criteria, DEQ has begun exploring options for incorporating the new criteria into various DEQ programs. Generally, DEQ intends to develop implementation procedures similar to EPA's *Guidance for Implementing the January 2001 Methylmercury Criterion*.

G.3.1. NPDES Permitting

DEQ intends to develop implementation procedures based on EPA's *Guidance for Implementing the January 2001 Methylmercury Criterion*. A variety of situations exist throughout Oregon that are addressed in EPA's implementation guidance, including waterbodies with mercury TMDLs, waters listed as impaired without TMDLs, and other waters with insufficient methylmercury data. DEQ will use the options as described in EPA's guidance to develop additional detail regarding how DEQ will implement the new criterion in various circumstances, once adopted by the Environmental Quality Commission and approved by EPA.

G.3.1.2. TMDLs

DEQ intends to make use of EPA's guidance in developing TMDLs and notes that it is fairly flexible and provides DEQ with several options. However, the guidance is written to address waterbodies that are dominated by direct air deposition of mercury, as found in the mid-west and east coast states. In contrast, Oregon is not dominated by direct air deposition of mercury.

In addition to EPA's Guidance, DEQ may also utilize EPA Region 10's Mercury Reduction Strategy in implementing a methylmercury criterion of which DEQ was a key stakeholder in the development of this strategy. Additionally, implementation may include the results of Region 10's *"Development of a Monitoring Guide to Support Water-Resource Assessments for Mercury within EPA Region X"*. This work may help answer questions related to mercury methylation and bioaccumulation in fish tissue.

Oregon's methylmercury criterion implementation strategy from a TMDL perspective would:

- Utilize an environmentally relevant analytical approach that could be conducted on a seasonal basis and include general water and sediment quality parameters that are known to methylate mercury, which could allow for a spatially appropriate bioaccumulation factor to be calculated.
- Focus either on a regional or grouped (likely basin scale) spatial approach that would evaluate both mercury loading and methylmercury methylation.
- Spatially detailed models could be used that are dynamic for modeling fate and transport of both mercury and methylmercury, or a simplified regression model depending on the amount of data available for the analytical area.
- A linked model approach may be likely, especially in data rich areas such as the Willamette Basin. This method would include the use of EPA models: GBMM, WASP, and / or BASS
- Fish tissue could be monitored at a frequency of every 5 years at a minimum(DEQ is already developing a statewide baseline with the Toxics Monitoring Program).
- Relative source contribution analysis would include REMSAD air modeling from EPA for both far field (Asia) and near-field (in-basin sources) analysis.

Further discussion with EPA and DEQ staff in implementing the methylmercury criterion will occur following the commission's adoption of the rules.

G.4. Quantitation Limits

Approximately 48 percent of the proposed human health criteria have Quantification Limits (QLs) that are higher than the criterion. For that reason, pollutants may occur in Oregon's waterbodies at concentrations greater than the proposed criteria that cannot be measured given limitations in analytical methods. As a point of reference, approximately 40 percent of the currently effective criteria have QLs that are higher than the criterion. For permitting purposes, the QL becomes the compliance point for dischargers. Consequently, if the criterion for a particular pollutant becomes more stringent, but the QL remains higher than the criterion, there would be no effective change in the point of compliance until and unless analytical methods improve. Historically, the pace of change in laboratory methods has not been rapid. However, when methods do improve, there will likely be additional toxics impairment listings and more stringent water quality based effluent limits (WQBELs) for permit holders.

G.5. Effective Toxics Criteria Tables

DEQ is proposing a new Table 40 which will only contain criteria applicable to human health. Human health criteria will be deleted from Table 20, Table 33A, and Table 33B. These tables will remain a part of Oregon's water quality standards and only contain the aquatic life criteria. Once EPA takes action on the aquatic life criteria, DEQ will take action to combine the aquatic life criteria in Tables 20, 33A, and Table 33B into one table containing all of the aquatic life criteria.

Appendix A. Table 20 Redline/Strikethrough

TABLE 20

AQUATIC LIFE WATER QUALITY CRITERIA SUMMARY[1]

The concentration for each compound listed in Table 20 is a criterion not to be exceeded in waters of the state in order to protect aquatic life ~~and human health~~. All values are expressed as micrograms per liter (µg/L) except where noted. Compounds are listed in alphabetical order with the corresponding designations as to whether EPA has identified it as a priority pollutant and a carcinogen, aquatic life freshwater acute and chronic criteria, and aquatic life marine acute and chronic criteria, ~~human health water & organism and fish consumption only criteria, and Drinking Water Maximum Contaminant Level (MCL)~~. The acute criteria refer to the average concentration for one (1) hour and the chronic criteria refer to the average concentration for 96 hours (4 days), and that these criteria should not be exceeded more than once every three (3) years.

Compound Name (or Class)	Priority Pollutant	~~Carcinogen~~	Concentration in Micrograms Per Liter for Protection of Aquatic Life				~~Concentration in Units Per Liter for Protection of Human Health~~		
			Fresh Acute Criteria	Fresh Chronic Criteria	Marine Acute Criteria	Marine Chronic Criteria	~~Water and Fish Ingestion~~	~~Fish Consumption Only~~	~~Drinking Water M.C.L.~~
ACENAPTHENE	Y	~~N~~							
ACROLEIN	Y	~~N~~					~~320ug~~	~~780ug~~	

Compound Name (or Class)	Priority Pollutant	~~Carcinogen~~	Concentration in Micrograms Per Liter for Protection of Aquatic Life				~~Concentration in Units Per Liter for Protection of Human Health~~		
			Fresh Acute Criteria	Fresh Chronic Criteria	Marine Acute Criteria	Marine Chronic Criteria	~~Water and Fish Ingestion~~	~~Fish Consumption Only~~	~~Drinking Water M.C.L.~~
ACRYLONITRILE	Y	~~Y~~					~~0.058ug**~~	~~0.65ug**~~	
ALDRIN	Y	~~Y~~	3		1.3		~~0.074ng**~~	~~0.079ng**~~	
ALKALINITY	N	~~N~~		20,000					
AMMONIA	N	~~N~~	CRITERIA ARE pH AND TEMPERATURE DEPENDENT—SEE DOCUMENT USEPA JANUARY 1985 (Fresh Water) CRITERIA ARE pH AND TEMPERATURE DEPENDENT—SEE DOCUMENT USEPA APRIL 1989 (Marine Water)						
ANTIMONY	Y	~~N~~					~~146ug~~	~~45,000ug~~	
ARSENIC	Y	~~Y~~					~~2.2ng**~~	~~17.5ng**~~	~~0.05mg~~
ARSENIC (PENT)	Y	~~Y~~							
ARSENIC (TRI)	Y	~~Y~~	360	190	69	36			
ASBESTOS	Y	~~Y~~					~~30K f/L**~~		
BARIUM	N	~~N~~					~~1mg~~		~~1.0mg~~
BENZENE	Y	~~Y~~					~~0.66ug**~~	~~40 ug**~~	
BENZIDINE	Y	~~Y~~					~~0.12ng~~	~~0.53ng**~~	
BERYLLIUM	Y	~~Y~~					~~6.8ng**~~	~~117ng**~~	
BHC	Y	~~N~~							

Compound Name (or Class)	Priority Pollutant	~~Carcinogen~~	Concentration in Micrograms Per Liter for Protection of Aquatic Life				~~Concentration in Units Per Liter for Protection of Human Health~~		
			Fresh Acute Criteria	Fresh Chronic Criteria	Marine Acute Criteria	Marine Chronic Criteria	~~Water and Fish Ingestion~~	~~Fish Consumption Only~~	~~Drinking Water M.C.L.~~
CADMIUM	Y	~~N~~	3.9+	1.1+	43	9.3	~~10ug~~		~~0.010mg~~
CARBON TETRACHLORIDE	Y	~~Y~~					~~0.4ug**~~	~~6.94ug**~~	
CHLORDANE	Y	~~Y~~	2.4	0.0043	0.09	0.004	~~0.46ng**~~	~~0.48ng**~~	
CHLORIDE	N	~~N~~	860 mg/L	230 mg/L					
CHLORINATED BENZENES	Y	~~Y~~					~~488 ug~~		
CHLORINATED NAPHTHALENES	Y	~~N~~							
CHLORINE	N	~~N~~	19	11	13	7.5			
CHLOROALKYL ETHERS	Y	~~N~~							
CHLOROETHYL ETHER (BIS-2)	Y	~~Y~~					~~0.03 ug~~	~~1.36 ug**~~	
CHLOROFORM	Y	~~Y~~					~~0.19ug**~~	~~15.7ug**~~	
CHLOROISOPROPYL ETHER (BIS-2)	Y	~~N~~					~~34.7ug~~	~~4.36mg~~	
CHLOROMETHYL ETHER (BIS)	N	~~Y~~					~~0.00000376ng**~~	~~0.00184ug**~~	
CHLOROPHENOL 2	Y	~~N~~							
CHLOROPHENOL 4	N	~~N~~							

Compound Name (or Class)	Priority Pollutant	~~Carcinogen~~	Concentration in Micrograms Per Liter for Protection of Aquatic Life				~~Concentration in Units Per Liter for Protection of Human Health~~		
			Fresh Acute Criteria	Fresh Chronic Criteria	Marine Acute Criteria	Marine Chronic Criteria	~~Water and Fish Ingestion~~	~~Fish Consumption Only~~	~~Drinking Water M.C.L.~~
CHLOROPHENOXY HERBICIDES (2,4,5,-TP)	N	~~N~~					~~10ug~~		
CHLOROPHENOXY HERBICIDES (2,4-D)	N	~~N~~					~~100ug~~		
CHLORPYRIFOS	N	~~N~~	0.083	0.041	0.011	0.0056			
CHLORO-4 METHYL-3 PHENOL	N	~~N~~							
CHROMIUM (HEX)	Y	~~N~~	16	11	1,100	50	~~50ug~~		~~0.05mg~~
CHROMIUM (TRI)	N	~~N~~	1,700.+	210.+			~~170mg~~	~~3,433mg~~	~~0.05mg~~
COPPER	Y	~~N~~	18.+	12.+	2.9	2.9			
CYANIDE	Y	~~N~~	22	5.2	1	1	~~200ug~~		
DDT	Y	~~Y~~	1.1	0.001	0.13	0.001	~~0.024ng**~~	~~0.024ng**~~	
(TDE) DDT METABOLITE	Y	~~Y~~							
(DDE) DDT METABOLITE	Y	~~Y~~							
DEMETON	Y	~~N~~		0.1		0.1			
DIBUTYLPHTHALATE	Y	~~N~~					~~35mg~~	~~154mg~~	

Compound Name (or Class)	Priority Pollutant	~~Carcinogen~~	Concentration in Micrograms Per Liter for Protection of Aquatic Life				~~Concentration in Units Per Liter for Protection of Human Health~~		
			Fresh Acute Criteria	Fresh Chronic Criteria	Marine Acute Criteria	Marine Chronic Criteria	~~Water and Fish Ingestion~~	~~Fish Consumption Only~~	~~Drinking Water M.C.L.~~
DICHLOROBENZENES	Y	~~N~~					~~400ug~~	~~2.6mg~~	
DICHLOROBENZIDINE	Y	~~Y~~					~~0.01ug**~~	~~0.020ug**~~	
DICHLOROETHANE 1,2	Y	~~Y~~					~~0.94ug**~~	~~243ug**~~	
DICHLOROETHYLENES	Y	~~Y~~					~~0.033ug**~~	~~1.85ug**~~	
DICHLOROPHENOL 2,4	N	~~N~~					~~3.09mg~~		
DICHLOROPROPANE	Y	~~N~~							
DICHLOROPROPENE	Y	~~N~~					~~87ug~~	~~14.1mg~~	
DIELDRIN	Y	~~Y~~	2.5	0.0019	0.71	0.0019	~~0.071ng**~~	~~0.076ng**~~	
DIETHYLPHTHALATE	Y	~~N~~					~~350mg~~	~~1.8g~~	
DIMETHYL PHENOL 2,4	Y	~~N~~							
DIMETHYL PHTHALATE	Y	~~N~~					~~313mg~~	~~2.9g~~	
DINITROTOLUENE 2,4	N	~~Y~~					~~0.11ug**~~	~~9.1ug**~~	
DINITROTOLUENE	Y	~~N~~					~~70ug~~	~~14.3mg~~	
DINITROTOLUENE	N	~~Y~~							
DINITRO-O-CRESOL 2,4	Y	~~N~~					~~13.4~~	~~765ug~~	
DIOXIN (2,3,7,8-TCDD)	Y	~~Y~~					~~0.000013ng**~~	~~0.000014ng**~~	

Compound Name (or Class)	Priority Pollutant	~~Carcinogen~~	Concentration in Micrograms Per Liter for Protection of Aquatic Life				~~Concentration in Units Per Liter for Protection of Human Health~~		
			Fresh Acute Criteria	Fresh Chronic Criteria	Marine Acute Criteria	Marine Chronic Criteria	~~Water and Fish Ingestion~~	~~Fish Consumption Only~~	~~Drinking Water M.C.L.~~
DIPHENYLHYDRAZINE	Y	~~N~~					~~42ng**~~	~~0.56ug**~~	
DIPHENYLHYDRAZINE 1,2	Y	~~N~~							
DI-2-ETHYLHEXYL PHTHALATE	Y	~~N~~					~~15mg~~	~~50mg~~	
ENDOSULFAN	Y	~~N~~	0.22	0.056	0.034	0.0087	~~74ug~~	~~159ug~~	
ENDRIN	Y	~~N~~	0.18	0.0023	0.037	0.0023	~~1ug~~		~~0.0002mg~~
ETHYLBENZENE	Y	~~N~~					~~1.4mg~~	~~3.28mg~~	
FLUORANTHENE	Y	~~N~~					~~42ug~~	~~54ug~~	
GUTHION	N	~~N~~		0.01		0.01			
HALOETHERS	Y	~~N~~							
HALOMETHANES	Y	~~Y~~					~~0.19ug**~~	~~15.7ug**~~	
HEPTACHLOR	Y	~~Y~~	0.52	0.0038	0.053	0.0036	~~0.28ng**~~	~~0.29ng**~~	
HEXACHLOROETHANE	N	~~Y~~					~~1.9ug~~	~~8.74ug~~	
HEXACHLOROBENZENE	Y	~~N~~					~~0.72ng**~~	~~0.74ng**~~	
HEXACHLOROBUTADIENE	Y	~~Y~~					~~0.45ug**~~	~~50ug**~~	
HEXACHLOROCYCLOHEXANE (LINDANE)	Y	~~Y~~	2	0.08	0.16				~~0.004mg~~

Compound Name (or Class)	Priority Pollutant	~~Carcinogen~~	Concentration in Micrograms Per Liter for Protection of Aquatic Life				~~Concentration in Units Per Liter for Protection of Human Health~~		
			Fresh Acute Criteria	Fresh Chronic Criteria	Marine Acute Criteria	Marine Chronic Criteria	~~Water and Fish Ingestion~~	~~Fish Consumption Only~~	~~Drinking Water M.C.L.~~
HEXACHLOROCYCLOHEXANE-ALPHA	Y	~~Y~~					~~9.2ng**~~	~~31ng**~~	
HEXACHLOROCYCLOHEXANE-BETA	Y	~~Y~~					~~16.3ng**~~	~~54.7ng**~~	
HEXACHLOROCYCLOHEXANE-GAMA	Y	~~Y~~					~~18.6ng**~~	~~62.5ng**~~	
HEXACHLOROCYCLOHEXANE-TECHNICAL	Y	~~Y~~					~~12.3ng**~~	~~41.4ng**~~	
HEXACHLOROCYCLOPENTADIENE	Y	~~N~~					~~206ug~~		
IRON	N	~~N~~		1,000			~~0.3mg~~		
ISOPHORONE	Y	~~N~~					~~5.2mg~~	~~520mg~~	
LEAD	Y	~~N~~	82.+	3.2+	140	5.6	~~50ug~~		~~0.05mg~~
MALATHION	N	~~N~~		0.1		0.1			
MANGANESE	N	~~N~~					~~50ug~~	~~100ug~~	
MERCURY	Y	~~N~~	2.4	0.012	2.1	0.025	~~144ng~~	~~146ng~~	~~0.002mg~~
METHOXYCHLOR	N	~~N~~		0.03		0.03	~~100ug~~		~~0.1mg~~
MIREX	N	~~N~~		0.001		0.001			
MONOCHLOROBENZENE	Y	~~N~~					~~488ug~~		
NAPHTHALENE	Y	~~N~~							

Compound Name (or Class)	Priority Pollutant	~~Carcinogen~~	Concentration in Micrograms Per Liter for Protection of Aquatic Life				~~Concentration in Units Per Liter for Protection of Human Health~~		
			Fresh Acute Criteria	Fresh Chronic Criteria	Marine Acute Criteria	Marine Chronic Criteria	~~Water and Fish Ingestion~~	~~Fish Consumption Only~~	~~Drinking Water M.C.L.~~
NICKEL	Y	~~N~~	1,400.+	160+	75	8.3	~~13.4ug~~	~~100ug~~	
NITRATES	N	~~N~~					~~10mg~~		~~10mg~~
NITROBENZENE	Y	~~N~~					~~19.8mg~~		
NITROPHENOLS	Y	~~N~~							
NITROSAMINES	Y	~~Y~~					~~0.8ng**~~	~~1,240ng**~~	
NITROSODIBUTYLAMINE N	Y	~~Y~~					~~6.4ng**~~	~~587ng**~~	
NITROSODIETHYLAMINE N	Y	~~Y~~					~~0.8ng**~~	~~1,240ng**~~	
NITROSODIMETHYLAMINE N	Y	~~Y~~					~~1.4ng**~~	~~16,000ng**~~	
NITROSODIPHENYLAMINE N	Y	~~Y~~					~~4,900ng**~~	~~16,100ng**~~	
NITROSOPYRROLIDINE N	Y	~~Y~~					~~16ng**~~	~~91,900ng**~~	
PARATHION	N	~~N~~	0.065	0.013					
PCB's	Y	~~Y~~	2	0.014	10	0.03	~~0.079ng**~~	~~0.079ng**~~	
PENTACHLORINATED ETHANES	N	~~N~~							
PENTACHLOROBENZENE	N	~~N~~					~~74ug~~	~~85ug~~	
PENTACHLOROPHENOL	Y	~~N~~	***20	***13	13		~~1.01mg~~		

Compound Name (or Class)	Priority Pollutant	~~Carcinogen~~	Concentration in Micrograms Per Liter for Protection of Aquatic Life				~~Concentration in Units Per Liter for Protection of Human Health~~		
			Fresh Acute Criteria	Fresh Chronic Criteria	Marine Acute Criteria	Marine Chronic Criteria	~~Water and Fish Ingestion~~	~~Fish Consumption Only~~	~~Drinking Water M.C.L.~~
PHENOL	Y	~~N~~					~~3.5mg~~		
PHOSPHORUS ELEMENTAL	N	~~N~~				0.1			
PHTHALATE ESTERS	Y	~~N~~							
POLYNUCLEAR AROMATIC HYDROCARBONS	Y	~~Y~~					~~2.8ng**~~	~~31.1ng**~~	
SELENIUM	Y	~~N~~	260	35	410	54	~~10ug~~		~~0.01mg~~
SILVER	Y	~~N~~	4.1+	0.12	2.3		~~50ug~~		~~0.05mg~~
SULFIDE HYDROGEN SULFIDE	N	~~N~~		2		2			
TETRACHLORINATED ETHANES	Y	~~N~~							
TETRACHLOROBENZENE 1,2,4,5	Y	~~N~~					~~38ug~~	~~48ug~~	
TETRACHLOROETHANE 1,1,2,2	Y	~~Y~~					~~0.17ug**~~	~~10.7ug**~~	
TETRACHLOROETHANES	Y	~~N~~							
TETRACHLOROETHYLENE	Y	~~Y~~					~~0.8ug**~~	~~8.85ug**~~	
TETRACHLOROPHENOL 2,3,5,6	Y	~~N~~							
THALLIUM	Y	~~N~~					~~13ug~~	~~48ug~~	
TOLUENE	Y	~~N~~					~~14.3mg~~	~~424mg~~	

Compound Name (or Class)	Priority Pollutant	~~Carcinogen~~	Concentration in Micrograms Per Liter for Protection of Aquatic Life				~~Concentration in Units Per Liter for Protection of Human Health~~		
			Fresh Acute Criteria	Fresh Chronic Criteria	Marine Acute Criteria	Marine Chronic Criteria	~~Water and Fish Ingestion~~	~~Fish Consumption Only~~	~~Drinking Water M.C.L.~~
TOXAPHENE	Y	~~Y~~	0.73	0.0002	0.21	0.0002	~~0.71ng**~~	~~0.73ng**~~	~~0.005mg~~
TRICHLORINATED EtHANES	Y	~~Y~~							
TRICHLOROETHANE 1,1,1	Y	~~N~~					~~18.4mg~~	~~1.03g~~	
TRICHLOROETHANE 1,1,2	Y	~~Y~~					~~0.6ug**~~	~~41.8ug**~~	
TRICHLOROETHYLENE	Y	~~Y~~					~~2.7ug**~~	~~80.7ug**~~	
TRICHLOROPHENOL 2,4,5	N	~~N~~					~~2,600ug~~		
TRICHLOROPHENOL 2,4,6	Y	~~Y~~					~~1.2ug**~~	~~3.6ug**~~	
VINYL CHLORIDE	Y	~~Y~~					~~2ug**~~	~~525ug**~~	
ZINC	Y	~~N~~	120+	110+	95	86			

MEANING OF SYMBOLS:

g = grams ~~M.C.L = Maximum Contaminant Level~~

mg = milligrams + = Hardness Dependent Criteria (100 mg/L used).

The freshwater criterion for this metal is expressed as a function of hardness (mg/L) in the water column. Criteria values for hardness may be calculated from the following formulae (CMC refers to Acute Criteria; CCC refers to Chronic Criteria):

$CMC = (\exp(m_A*[\ln(hardness)] + b_A))*CF$

$CCC = (\exp(m_C*[\ln(hardness)] + b_C))*CF$

Chemical	m_A	b_A	m_C	b_C
Cadmium	1.128	-3.828	0.7852	-3.49
Chromium III	0.819	3.688	0.819	1.561
Copper	0.9422	-1.464	0.8545	-1.465
Lead	1.273	-1.46	1.273	-4.705
Nickel	0.846	3.3612	0.846	1.1645
Silver	1.72	-6.52		
Zinc	0.8473	0.8604	0.8473	0.7614

ug = micrograms

* = Insufficient data to develop criteria; value presented is the L.O.E.L – Lower Observed Effect Level.

ng = nanograms

pg = picograms

f = fibers

Y = Yes

N = No

** = Human health criteria for carcinogens reported for three risk levels. Value presented is the 10-6 risk level, which means the probability of one concern case per million people at the stated concentration.

*** = pH Dependent Criteria (7.8 pH used).

1 = Values in Table 20 are applicable to all basins.

Water and Fish Ingestion

Values represent the maximum ambient water concentration for consumption of both contaminated water and fish or other aquatic organisms.

Fish Ingestion

Values represent the maximum ambient water concentrations for consumption of fish or other aquatic organisms

Appendix B. Table 33A Redline/Strikethrough

TABLE 33A

Note: The Environmental Quality Commission adopted the following criteria on May 20, 2004 to become effective February 15, 2005. However, EPA has not yet (as of June 2006) approved the criteria. Thus, Table 33A criteria may be used in NPDES permits, but not for the section 303(d) list of impaired waters.

AQUATIC LIFE WATER QUALITY CRITERIA SUMMARY[A]

The concentration for each compound listed in Table 33A is a criterion not to be exceeded in waters of the state in order to protect aquatic life ~~and human health~~. All values are expressed as micrograms per liter (µg/L) except where noted. Compounds are listed in alphabetical order with the corresponding EPA number (from National Recommended Water Quality Criteria: 2002, EPA-822-R-02-047), the Chemical Abstract Service (CAS) number, aquatic life freshwater acute and chronic criteria, aquatic life saltwater acute and chronic criteria~~, human health water & organism and organism only criteria~~, and Drinking Water Maximum Contaminant Level (MCL). The acute criteria refer to the average concentration for one (1) hour and the chronic criteria refer to the average concentration for 96 hours (4 days), and that these criteria should not be exceeded more than once every three (3) years.

EPA NO.	Compound			CAS Number	Freshwater				Saltwater				~~Human Health For Consumption of:~~				
					Acute (CMC)	Effective Date	Chronic (CCC)	Effective Date	Acute (CMC)	Effective Date	Chronic (CCC)	Effective	~~Water + Organism~~ [B]	~~Effective~~	~~Organism only~~ [B]	~~Effective~~	~~Drinking Water M.C.L.~~
56	Acenaphthene			83329									~~670~~		~~990~~		
57	Acenaphthylene			208968													

EPA NO.	Compound			CAS Number	Freshwater				Saltwater				~~Human Health For Consumption of:~~				
					Acute (CMC)	Effective Date	Chronic (CCC)	Effective Date	Acute (CMC)	Effective Date	Chronic (CCC)	Effective	~~Water + Organism [B]~~	~~Effective~~	~~Organism only [B]~~	~~Effective~~	~~Drinking Water M.C.L.~~
17	Acrolein			107028									~~190~~		~~290~~		
18	Acrylonitrile			107131									~~0.051~~		~~0.250~~		
102	Aldrin			309002	3 O	X			1.3 O	X			~~0.000049~~		~~0.000050~~		
1 N	Alkalinity						20,000 P										
2 N	Aluminum (pH 6.5 - 9.0)			7429905													
3 N	Ammonia			7664417					D	X	D	X					
58	Anthracene			120127									~~8300~~		~~40000~~		
1	Antimony			7440360									~~5.6~~		~~640~~		
2	Arsenic			7440382													~~0.05mg~~
15	Asbestos			1332214													

EPA NO.	Compound			CAS Number	Freshwater				Saltwater				~~Human Health For Consumption of:~~				
					Acute (CMC)	Effective Date	Chronic (CCC)	Effective Date	Acute (CMC)	Effective Date	Chronic (CCC)	Effective	~~Water + Organism [B]~~	~~Effective~~	~~Organism only [B]~~	~~Effective~~	~~Drinking Water M.C.L.~~
6 N	Barium			7440393									~~1000~~				~~1.0mg~~
19	Benzene			71432													
59	Benzidine			92875									~~0.00008 6~~		~~0.00020~~		
60	Benzo(a)Anthracene			56553									~~0.0038~~		~~0.018~~		
61	Benzo(a)Pyrene			50328									~~0.0038~~		~~0.018~~		
62	Benzo(b)Fluoranthene			205992									~~0.0038~~		~~0.018~~		
63	Benzo(g,h,i)Perylene			191242													
64	Benzo(k)Fluoranthene			207089									~~0.0038~~		~~0.018~~		
3	Beryllium			7440417													
103	BHC alpha-			319846									~~0.0026~~		~~0.0049~~		
104	BHC beta-			319857									~~0.0091~~		~~0.017~~		
106	BHC delta-			319868													
105	BHC gamma- (Lindane)			58899	0.95		0.08	X	0.16 O								~~0.004mg~~
7 N	Boron			7440428													

EPA NO.	Compound			CAS Number	Freshwater				Saltwater				~~Human Health For Consumption of:~~				
					Acute (CMC)	Effective Date	Chronic (CCC)	Effective Date	Acute (CMC)	Effective Date	Chronic (CCC)	Effective	~~Water + Organism [B]~~	~~Effective~~	~~Organism only [B]~~	~~Effective~~	~~Drinking Water M.C.L.~~
20	Bromoform			75252									~~4.3~~		~~140~~		
69	Bromophenyl Phenyl Ether 4-																
70	Butylbenzyl Phthalate			85687									~~1500~~		~~1900~~		
4	Cadmium			7440439													~~0.010mg~~
21	Carbon Tetrachloride			56235									~~0.23~~		~~1.6~~		
107	Chlordane			57749	2.4 O	X	0.0043 O	X	0.09 O	X	0.004 O	X					
8 N	Chloride			16887006	860000		230000										
9 N	Chlorine			7782505	19	X	11	X	13	X	7.5	X					
22	Chlorobenzene			108907									~~130~~		~~1600~~		
23	Chlorodibromomethane			124481									~~0.40~~		~~13~~		
24	Chloroethane			75003													

EPA NO.	Compound			CAS Number	Freshwater				Saltwater				~~Human Health For Consumption of:~~				
					Acute (CMC)	Effective Date	Chronic (CCC)	Effective Date	Acute (CMC)	Effective Date	Chronic (CCC)	Effective	~~Water + Organism [B]~~	~~Effective~~	~~Organism only [B]~~	~~Effective~~	~~Drinking Water M.C.L.~~
65	ChloroethoxyMethane Bis2-			111911													
66	ChloroethylEther Bis2-			111444									~~0.030~~		~~0.53~~		
25	Chloroethylvinyl Ether 2-			110758													
26	Chloroform			67663													
67	ChloroisopropylEther Bis2-			108601													
15 N	ChloromethylEther, Bis			542881											~~0.00029~~		
71	Chloronaphthalene 2-			91587									~~1000~~		~~1600~~		
45	Chlorophenol 2-			95578									~~81~~		~~150~~		
10 N	Chlorophenoxy Herbicide (2,4,5,-TP)			93721									~~10 H~~				
11 N	Chlorophenoxy Herbicide (2,4-D)			94757									~~100 H~~				
72	Chlorophenyl Phenyl Ether 4-			7005723													
12 N	Chloropyrifos			2921882	0.083	X	0.041	X	0.011	X	0.0056	X					

EPA NO.	Compound			CAS Number	Freshwater				Saltwater				~~Human Health For Consumption of:~~				
					Acute (CMC)	Effective Date	Chronic (CCC)	Effective Date	Acute (CMC)	Effective Date	Chronic (CCC)	Effective	~~Water + Organism [B]~~	~~Effective~~	~~Organism only [B]~~	~~Effective~~	~~Drinking Water M.C.L.~~
																	~~0.05mg~~
5a	Chromium (III)																~~0.05mg~~
5b	Chromium (VI)			18540299													~~0.05mg~~
73	Chrysene			218019									~~0.0038~~		~~0.018~~		
6	Copper			7440508									~~1300 H~~				
14	Cyanide			57125	22 S	X	5.2 S	X	1 S	X	1 S	X	~~140~~		~~140~~		
108	DDT 4,4'-			50293	1.1 O,T	X	0.001 O,T	X	0.13 O,T	X	0.001 O,T	X					
109	DDE 4,4'-			72559									~~0.00022~~		~~0.00022~~		
110	DDD 4,4'-			72548									~~0.00031~~		~~0.00031~~		
14N	Demeton			8065483			0.1	X			0.1	X					
74	Dibenzo(a,h)Anthracene			53703									~~0.0038~~		~~0.018~~		

EPA NO.	Compound			CAS Number	Freshwater				Saltwater				~~Human Health For Consumption of:~~				
					Acute (CMC)	Effective Date	Chronic (CCC)	Effective Date	Acute (CMC)	Effective Date	Chronic (CCC)	Effective	~~Water + Organism [B]~~	~~Effective~~	~~Organism only [B]~~	~~Effective~~	~~Drinking Water M.C.L.~~
75	Dichlorobenzene 1,2-			95501									~~420~~		~~1300~~		
76	Dichlorobenzene 1,3-			541731									~~320~~		~~960~~		
77	Dichlorobenzene 1,4-			106467									~~63~~		~~190~~		
78	Dichlorobenzidine 3,3'-			91941									~~0.021~~		~~0.028~~		
27	Dichlorobromomethane			75274									~~0.55~~		~~17~~		
28	Dichloroethane 1,1-			75343													
29	Dichloroethane 1,2-			107062									~~0.38~~		~~37~~		
30	Dichloroethylene 1,1-			75354									~~330~~		~~7100~~		
46	Dichlorophenol 2,4-			120832									~~77~~		~~290~~		
31	Dichloropropane 1,2-			78875									~~0.50~~		~~15~~		
32	Dichloropropene 1,3-			542756									~~0.34~~		~~21~~		
111	Dieldrin			60571	0.24				0.71 O	X	0.0019 O	X	~~0.000052~~		~~0.000054~~		
79	DiethylPhthalate			84662									~~17000~~		~~44000~~		
47	Dimethylphenol 2,4-			105679									~~380~~		~~850~~		

EPA NO.	Compound			CAS Number	Freshwater				Saltwater				~~Human Health For Consumption of:~~				
					Acute (CMC)	Effective Date	Chronic (CCC)	Effective Date	Acute (CMC)	Effective Date	Chronic (CCC)	Effective	~~Water + Organism [B]~~	~~Effective~~	~~Organism only [B]~~	~~Effective~~	~~Drinking Water M.C.L.~~
80	DimethylPhthalate			131113									~~270000~~		~~1100000~~		
81	Di-n-Butyl Phthalate			84742									~~2000~~		~~4500~~		
49	Dinitrophenol 2,4-			51285									~~69~~		~~5300~~		
27 N	Dinitrophenols			2555058 7									~~69~~		~~5300~~		
82	Dinitrotoluene 2,4-			121142									~~0.11~~		~~3.4~~		
83	Dinitrotoluene 2,6-			606202													
84	Di-n-Octyl Phthalate			117840													
16	Dioxin (2,3,7,8-TCDD)			1746016									~~5.0E-09~~		~~5.1E-09~~		
85	Diphenylhydrazine 1,2-			122667									~~0.036~~		~~0.20~~		
68	EthylhexylPhthalate Bis2-			117817									~~1.2~~		~~2.2~~		

EPA NO.	Compound			CAS Number	Freshwater				Saltwater				~~Human Health For Consumption of:~~				
					Acute (CMC)	Effective Date	Chronic (CCC)	Effective Date	Acute (CMC)	Effective Date	Chronic (CCC)	Effective	~~Water + Organism [B]~~	~~Effective~~	~~Organism only [B]~~	~~Effective~~	~~Drinking Water M.C.L.~~
	Endosulfan				0.22 I,P	X	0.056 I,P	X	0.034 I,P	X	0.0087 I,P	X	~~62 I~~		~~89 I~~		
112	Endosulfan alpha-			959988	0.22 O		0.056 O		0.034 O		0.0087 O		~~62~~		~~89~~		
113	Endosulfan beta-			33213659	0.22 O		0.056 O		0.034 O		0.0087 O		~~62~~		~~89~~		
114	Endosulfan Sulfate			1031078									~~62~~		~~89~~		
115	Endrin			72208	0.086				0.037 O		0.0023 O		~~0.059~~		~~0.060~~		~~0.0002 mg~~
116	Endrin Aldehyde			7421934									~~0.29~~		~~0.30~~		
33	Ethylbenzene			100414									~~530~~		~~2100~~		
86	Fluoranthene			206440													
87	Fluorene			86737									~~1100~~		~~5300~~		
17 N	Guthion			86500			0.01	X			0.01	X					

EPA NO.	Compound			CAS Number	Freshwater				Saltwater				~~Human Health For Consumption of:~~				
					Acute (CMC)	Effective Date	Chronic (CCC)	Effective Date	Acute (CMC)	Effective Date	Chronic (CCC)	Effective	~~Water + Organism [B]~~	~~Effective~~	~~Organism only [B]~~	~~Effective~~	~~Drinking Water M.C.L.~~
117	Heptachlor			76448	0.52 O	X	0.0038 O	X	0.053 O	X	0.0036 O	X	~~0.00007 9~~		~~0.00007 9~~		
118	Heptachlor Epoxide			1024573	0.52 O		0.0038 O		0.053 O		0.0036 O		~~0.00003 9~~		~~0.00003 9~~		
88	Hexachlorobenzene			118741									~~0.00028~~		~~0.00029~~		
89	Hexachlorobutadiene			87683									~~0.44~~		~~18~~		
91	Hexachloroethane			67721									~~1.4~~		~~3.3~~		
19 N	Hexachlorocyclo-hexane-Technical			319868									~~0.0123 J~~		~~0.0414 J~~		
90	Hexachlorocyclopentadiene			77474									~~40~~		~~1100~~		
92	Ideno1,2,3-(cd)Pyrene			193395									~~0.0038~~		~~0.018~~		

EPA NO.	Compound			CAS Number	Freshwater				Saltwater				~~Human Health For Consumption of:~~				
					Acute (CMC)	Effective Date	Chronic (CCC)	Effective Date	Acute (CMC)	Effective Date	Chronic (CCC)	Effective	~~Water + Organism [B]~~	~~Effective~~	~~Organism only [B]~~	~~Effective~~	~~Drinking Water M.C.L.~~
20 N	Iron			7439896			1,000	X									
93	Isophorone			78591									~~35~~		~~960~~		
7	Lead			7439921													~~0.05mg~~
21 N	Malathion			121755			0.1	X			0.1	X					
22 N	Manganese			7439965													
8a	Mercury			7439976	2.4	X	0.012	X	2.1	X	0.025	X					~~0.002mg~~
23 N	Methoxychlor			72435			0.03	X			0.03	X	~~100 J~~				~~0.1mg~~
34	Methyl Bromide			74839									~~47~~		~~1500~~		
35	Methyl Chloride			74873													
48	Methyl-4,6-Dinitrophenol 2-			534521									~~13~~		~~280~~		
52	Methyl-4-Chlorophenol 3-			59507													
36	Methylene Chloride			75092									~~4.6~~		~~590~~		
8b	Methylmercury			22967926											~~300ug/kg L~~		

EPA NO.	Compound			CAS Number	Freshwater				Saltwater				Human Health For Consumption of:				
					Acute (CMC)	Effective Date	Chronic (CCC)	Effective	Acute (CMC)	Effective Date	Chronic (CCC)	Effective	Water + Organism [B]	Effective	Organism only [B]	Effective	Drinking Water M.C.L.
24 N	Mirex			2385855			0.001	X			0.001	X					
94	Naphthalene			91203													
9	Nickel			7440020													
25 N	Nitrates			14797558									10000 J				10mg
95	Nitrobenzene			98953									17		690		
50	Nitrophenol 2-			88755													
51	Nitrophenol 4-			100027													
26 N	Nitrosamines			35576911									0.0008 J		1.24 J		
28 N	Nitrosodibutylamine,N			924163									0.0063		0.22		
29 N	Nitrosodiethylamine,N			55185									0.0008 J		1.24 J		
96	N-Nitrosodimethylamine			62759									0.00069		3.0		

EPA NO.	Compound			CAS Number	Freshwater				Saltwater				Human Health For Consumption of:				
					Acute (CMC)	Effective Date	Chronic (CCC)	Effective Date	Acute (CMC)	Effective Date	Chronic (CCC)	Effective	Water + Organism [B]	Effective	Organism only [B]	Effective	Drinking Water M.C.L.
98	N-Nitrosodiphenylamine			86306									3.3		6.0		
30 N	Nitrosopyrrolidine,N			930552									0.016		34		
97	N-Nitrosodi-n-Propylamine			621647									0.0050		0.51		
32 N	Oxygen, Dissolved			7782447													
33 N	Parathion			56382	0.065	X	0.013	X									
119	Polychlorinated Biphenyls PCBs:			1336363	2 U	X	0.014 U	X	10 U	X	0.03 U	X	0.000064 U		0.000064 U		
34 N	Pentachlorobenzene			608935									1.4		1.5		
53	Pentachlorophenol			87865	M				13		7.9		0.27		3.0		
99	Phenanthrene			85018													
54	Phenol			108952											1700000		
36 N	Phosphorus Elemental			7723140							0.1						

EPA NO.	Compound			CAS Number	Freshwater				Saltwater				~~Human Health For Consumption of:~~				
					Acute (CMC)	Effective Date	Chronic (CCC)	Effective Date	Acute (CMC)	Effective Date	Chronic (CCC)	Effective	~~Water + Organism [B]~~	~~Effective~~	~~Organism only [B]~~	~~Effective~~	~~Drinking Water M.C.L.~~
100	Pyrene			129000									~~830~~		~~4000~~		
10	Selenium			7782492											~~4200~~		~~0.01mg~~
11	Silver			7440224													~~0.05mg~~
40 N	Sulfide-Hydrogen Sulfide			7783064			2	X			2	X					
43 N	Tetrachlorobenzene,1,2,4,5			95943									~~0.97~~		~~1.1~~		
37	Tetrachloroethane 1,1,2,2-			79345									~~0.17~~		~~4.0~~		
38	Tetrachloroethylene			127184									~~0.69~~		~~3.3~~		
12	Thallium			7440280									~~0.24~~		~~0.47~~		
39	Toluene			108883									~~1300~~		~~15000~~		

EPA NO.	Compound			CAS Number	Freshwater				Saltwater				Human Health For Consumption of:				
					Acute (CMC)	Effective Date	Chronic (CCC)	Effective Date	Acute (CMC)	Effective Date	Chronic (CCC)	Effective	~~Water + Organism [B]~~	~~Effective~~	~~Organism only [B]~~	~~Effective~~	~~Drinking Water M.C.L.~~
120	Toxaphene			8001352	0.73	X	0.0002	X	0.21	X	0.0002	X	~~0.00028~~		~~0.00028~~		~~0.005mg~~
40	Trans-Dichloroethylene 1,2-			156605									~~140~~		~~10000~~		
44 N	Tributyltin (TBT)			688733													
101	Trichlorobenzene 1,2,4-			120821									~~35~~		~~70~~		
41	Trichloroethane 1,1,1-			71556													
42	Trichloroethane 1,1,2-			79005									~~0.59~~		~~16~~		
43	Trichloroethylene			79016									~~2.5~~		~~30~~		
45 N	Trichlorophenol 2,4,5			95954									~~1800~~		~~3600~~		
55	Trichlorophenol 2,4,6-			88062											~~2.4~~		
44	Vinyl Chloride			75014									~~0.025~~		~~2.4~~		
13	Zinc			7440666									~~7400~~		~~26000~~		

Footnotes for Tables 33A and 33B:

A Values in Table 20 are applicable to all basins.

~~B Human Health criteria values were calculated using a fish consumption rate of 17.5 grams per day (0.6 ounces/day) unless otherwise noted.~~

C Ammonia criteria for freshwater may depend on pH, temperature, and the presence of salmonids or other fish with ammonia-sensitive early life stages. Values for freshwater criteria (of total ammonia nitrogen in mg N/L) can be calculated using the formulae specified in *1999 Update of Ambient Water Quality Criteria for Ammonia* (EPA-822-R-99-014; http://www.epa.gov/ost/standards/ammonia/99update.pdf):

Freshwater Acute:

salmonids present….CMC = $\frac{0.275}{1+10^{7.204-pH}}+\frac{39.0}{1+10^{pH-7.204}}$

salmonids not present…CMC= $\frac{0.411}{1+10^{7.204-pH}}+\frac{58.4}{1+10^{pH-7.204}}$

Freshwater Chronic:

fish early life stages present

CCC = $\frac{0.0577}{1+10^{7.688-pH}}+\frac{2.487}{1+10^{pH-7.688}}$ * $MIN(2.85, 1.45*10^{0.028*(25-T)})$

fish early life stages not present

CCC= $\frac{0.0577}{1+10^{7.688-pH}}+\frac{2.487}{1+10^{pH-7.688}}$ * $1.45*10^{0.028*(25-MAX(T,7))}$

Note: these chronic criteria formulae would be applied to calculate the 30-day average concentration limit; in addition, the highest 4-day average within the 30-day period should not exceed 2.5 times the CCC.

D Ammonia criteria for saltwater may depend on pH and temperature. Values for saltwater criteria (total ammonia) can be calculated from the tables specified in *Ambient Water Quality Criteria for Ammonia (Saltwater)--1989* (EPA 440/5-88-004; http://www.epa.gov/ost/pc/ambientwqc/ammoniasalt1989.pdf).

E Freshwater and saltwater criteria for metals are expressed in terms of "dissolved" concentrations in the water column, except where otherwise noted (e.g. aluminum).

F The freshwater criterion for this metal is expressed as a function of hardness (mg/L) in the water column. Criteria values for hardness may be calculated from the following formulae (CMC refers to Acute Criteria; CCC refers to Chronic Criteria):

$$CMC = (\exp(m_A*[\ln(hardness)] + b_A))*CF$$

$$CCC = (\exp(m_C*[\ln(hardness)] + b_C))*CF$$

where CF is the conversion factor used for converting a metal criterion expressed as the total recoverable fraction in the water column to a criterion expressed as the dissolved fraction in the water column.

Chemical	m_A	b_A	m_C	b_C
Cadmium	1.0166	-3.924	0.7409	-4.719
Chromium III	0.8190	3.7256	0.8190	0.6848
Copper	0.9422	-1.700	0.8545	-1.702
Lead	1.273	-1.460	1.273	-4.705
Nickel	0.8460	2.255	0.8460	0.0584
Silver	1.72	-6.59		
Zinc	0.8473	0.884	0.8473	0.884

Conversion factors (CF) for dissolved metals (the values for total recoverable metals criteria were multiplied by the appropriate conversion factors shown below to calculate the dissolved metals criteria):

Chemical	Freshwater		Saltwater	
	Acute	Chronic	Acute	Chronic
Arsenic	1.000	1.000	1.000	1.000
Cadmium	1.136672-[(ln hardness)(0.041838)]	1.101672-[(ln hardness)(0.041838)]	0.994	0.994
Chromium III	0.316	0.860	--	--
Chromium VI	0.982	0.962	0.993	0.993
Copper	0.960	0.960	0.83	0.83
Lead	1.46203-[(ln hardness)(0.145712)]	1.46203-[(ln hardness)(0.145712)]	0.951	0.951
Nickel	0.998	0.997	0.990	0.990
Selenium	0.996	0.922	0.998	0.998
Silver	0.85	0.85	0.85	--
Zinc	0.978	0.986	0.946	0.946

~~G Human Health criterion is the same as originally published in the 1976 EPA Red Book (Quality Criteria for Water, EPA-440/9-76-023) which predates the 1980 methodology and did not use the fish ingestion BCF approach.~~

~~H This value is based on a Drinking Water regulation.~~

I This value is based on criterion published in Ambient Water Quality Criteria for Endosulfan (EPA 440/5-80-046) and should be applied as the sum of alpha- and beta-endosulfan.

~~J No BCF was available; therefore, this value is based on that published in the 1986 EPA Gold Book.~~

~~K Human Health criterion is for "dissolved" concentration based on the 1976 EPA Red Book conclusion that adverse effects from exposure at this level are aesthetic rather than toxic.~~

~~L This value is expressed as the fish tissue concentration of methylmercury.~~

M Freshwater aquatic life values for pentachlorophenol are expressed as a function of pH, and are calculated as follows: CMC=(exp(1.005(pH)-4.869); CCC=exp(1.005(pH)-5.134).

N This number was assigned to the list of non-priority pollutants in National Recommended Water Quality Criteria: 2002 (EPA-822-R-02-047).

O This criterion is based on EPA recommendations issued in 1980 that were derived using guidelines that differed from EPA's 1985 Guidelines for minimum data requirements and derivation procedures. For example, a "CMC" derived using the 1980 Guidelines was derived to be used as an instantaneous maximum. If assessment is to be done using an averaging period, the values given should be divided by 2 to obtain a value that is more comparable to a CMC derived using the 1985 Guidelines.

P Criterion shown is the minimum (i.e. CCC in water should not be below this value in order to protect aquatic life).

Q Criterion is applied as total arsenic (i.e. arsenic (III) + arsenic (V)).

R Arsenic criterion refers to the inorganic form only.

S This criterion is expressed as µg free cyanide (CN)/L.

T This criterion applies to DDT and its metabolites (i.e. the total concentration of DDT and its metabolites should not exceed this value).

U This criterion applies to total PCBs (e.g. the sum of all congener or all isomer or homolog or Arochlor analyses).

V The CMC=1/[(f1/CMC1)+(f2/CMC2)] where f1 and f2 are the fractions of total selenium that are treated as selenite and selenate, respectively, and CMC1 and CMC2 are 185.9 µg/L and 12.82 µg/L, respectively.

W The acute and chronic criteria for aluminum are 750 µg/L and 87 µg/L, respectively. These values for aluminum are expressed in terms of "total recoverable" concentration of metal in the water column. The criterion applies at pH<6.6 and hardness<12 mg/L (as $CaCO_3$).

X The effective date for the criterion in the column immediately to the left is 1991.

Y No criterion.

Appendix C. Table 33B Redline/Strikethrough

TABLE 33B

Note: The Environmental Quality Commission adopted the following criteria on May 20, 2004 to become effective on EPA approval. EPA has not yet (as of June 2006) approved these criteria. The Table 33B criteria may not be used until they are approved by EPA.

AQUATIC LIFE WATER QUALITY CRITERIA SUMMARY[A]

The concentration for each compound listed in Table 33A is a criterion not to be exceeded in waters of the state in order to protect aquatic life ~~and human health~~. All values are expressed as micrograms per liter (µg/L) except where noted. Compounds are listed in alphabetical order with the corresponding EPA number (from National Recommended Water Quality Criteria: 2002, EPA-822-R-02-047), the Chemical Abstract Service (CAS) number, aquatic life freshwater acute and chronic criteria, aquatic life saltwater acute and chronic criteria, ~~human health water & organism and organism only criteria~~, and Drinking Water Maximum Contaminant Level (MCL). The acute criteria refer to the average concentration for one (1) hour and the chronic criteria refer to the average concentration for 96 hours (4 days), and that these criteria should not be exceeded more than once every three (3) years.

EPA NO.	Compound			CAS Number	Freshwater				Saltwater				~~Human Health For Consumption of:~~				
					Acute (CMC)	Effective Date	Chronic (CCC)	Effective Date	Acute (CMC)	Effective Date	Chronic (CCC)	Effective	~~Water + Organism~~ [B]	~~Effective~~	~~Organism only~~ [B]	~~Effective~~	
2 N	Aluminum (pH 6.5 - 9.0)			7429905	W		W										
3 N	Ammonia			7664417	C		C										
2	Arsenic			7440382									~~0.018 R~~		~~0.14 R~~		
15	Asbestos			1332214									~~7.0E+06 fibers/Liter~~				

EPA NO.	Compound			CAS Number	Freshwater				Saltwater				Human Health For Consumption of:				
					Acute (CMC)	Effective Date	Chronic (CCC)	Effective Date	Acute (CMC)	Effective Date	Chronic (CCC)	Effective	~~Water + Organism~~ [B]	~~Effective~~	~~Organism only~~ [B]	~~Effective~~	
19	Benzene			71432									~~2.2~~		~~51~~		
3	Beryllium			7440417									~~¥~~		~~¥~~		
105	BHC gamma- (Lindane)			58899									~~0.98~~		~~1.8~~		
4	Cadmium			7440439	E,F		E,F		40 E		8.8 E		~~¥~~				
107	Chlordane			57749									~~0.00080~~		~~0.00081~~		
	CHLORINATED BENZENES												~~¥~~		~~¥~~		
26	Chloroform			67663									~~5.7~~		~~470~~		
67	ChloroisopropylEther Bis2-			108601									~~1400~~		~~65000~~		
15 N	ChloromethylEther, Bis			542881									~~0.00010~~				
5a	Chromium (III)				E,F		E,F						~~¥~~				
5b	Chromium (VI)			18540299	16 E		11 E						~~¥~~		~~¥~~		
6	Copper			7440508	E,F		E,F		4.8 E		3.1 E						
108	DDT 4,4'-			50293									~~0.00022~~		~~0.00022~~		
	DIBUTYLPHTHALATE												~~¥~~		~~¥~~		

EPA NO.	Compound			CAS Number	Freshwater				Saltwater				Human Health For Consumption of:				
					Acute (CMC)	Effective Date	Chronic (CCC)	Effective Date	Acute (CMC)	Effective Date	Chronic (CCC)	Effective	~~Water + Organism~~ [B]	~~Effective~~	~~Organism only~~ [B]	~~Effective~~	
	DICHLOROBENZENES												~~¥~~		~~¥~~		
	DICHLOROBENZIDINE												~~¥~~		~~¥~~		
	DICHLOROETHYLENES												~~¥~~		~~¥~~		
	DICHLOROPROPENE												~~¥~~		~~¥~~		
111	Dieldrin			60571			0.056										
	DINITROTOLUENE												~~¥~~		~~¥~~		
	DIPHENYLHYDRAZINE												~~¥~~		~~¥~~		
115	Endrin			72208			0.036										
86	Fluoranthene			206440									~~130~~		~~140~~		
	HALOMETHANES												~~¥~~		~~¥~~		
20 N	Iron			7439896									~~300 K~~				
7	Lead			7439921	E,F		E,F		210 E		8.1 E		~~¥~~				
22 N	Manganese			7439965									~~50 K~~		~~100 K~~		
8a	Mercury			7439976									~~¥~~		~~¥~~		

EPA NO.	Compound			CAS Number	Freshwater				Saltwater				Human Health For Consumption of:				
					Acute (CMC)	Effective Date	Chronic (CCC)	Effective Date	Acute (CMC)	Effective Date	Chronic (CCC)	Effective	Water + Organism [B]	Effective	Organism only [B]	Effective	
	MONOCHLOROBENZENE												¥		¥		
9	Nickel			7440020	E,F		E,F		74 E		8.2 E		610		4600		
53	Pentachlorophenol			87865			M										
54	Phenol			108952									21000				
	POLYNUCLEAR AROMATIC HYRDOCARBONS												¥		¥		
10	Selenium			7782492	E,V		5 E		290 E		71 E		170				
11	Silver			7440224	E,F,P		0.10 E		1.9 E,P				¥				
44 N	Tributyltin (TBT)			688733	0.46		0.063		0.37		0.01						
41	Trichloroethane 1,1,1-			71556									¥		¥		
55	Trichlorophenol 2,4,6-			88062									1.4				
13	Zinc			7440666	E,F		E,F		90 E		81 E						

Footnotes for Tables 33A and 33B:

A Values in Table 20 are applicable to all basins.

~~B Human Health criteria values were calculated using a fish consumption rate of 17.5 grams per day (0.6 ounces/day) unless otherwise noted.~~

C Ammonia criteria for freshwater may depend on pH, temperature, and the presence of salmonids or other fish with ammonia-sensitive early life stages. Values for freshwater criteria (of total ammonia nitrogen in mg N/L) can be calculated using the formulae specified in *1999 Update of Ambient Water Quality Criteria for Ammonia* (EPA-822-R-99-014; http://www.epa.gov/ost/standards/ammonia/99update.pdf):

Freshwater Acute:

salmonids present….CMC = $\frac{0.275}{1+10^{7.204-pH}}+\frac{39.0}{1+10^{pH-7.204}}$

salmonids not present…CMC= $\frac{0.411}{1+10^{7.204-pH}}+\frac{58.4}{1+10^{pH-7.204}}$

Freshwater Chronic:

fish early life stages present

CCC = $\left(\frac{0.0577}{1+10^{7.688-pH}}+\frac{2.487}{1+10^{pH-7.688}}\right)*MIN(2.85, 1.45*10^{0.028*(25-T)})$

fish early life stages not present

CCC= $\left(\frac{0.0577}{1+10^{7.688-pH}}+\frac{2.487}{1+10^{pH-7.688}}\right)*1.45*10^{0.028*(25-MAX(T,7))}$

Note: these chronic criteria formulae would be applied to calculate the 30-day average concentration limit; in addition, the highest 4-day average within the 30-day period should not exceed 2.5 times the CCC.

D Ammonia criteria for saltwater may depend on pH and temperature. Values for saltwater criteria (total ammonia) can be calculated from the tables specified in *Ambient Water Quality Criteria for Ammonia (Saltwater)--1989* (EPA 440/5-88-004; http://www.epa.gov/ost/pc/ambientwqc/ammoniasalt1989.pdf).

E Freshwater and saltwater criteria for metals are expressed in terms of "dissolved" concentrations in the water column, except where otherwise noted (e.g. aluminum).

F The freshwater criterion for this metal is expressed as a function of hardness (mg/L) in the water column. Criteria values for hardness may be calculated from the following formulae (CMC refers to Acute Criteria; CCC refers to Chronic Criteria):

$$CMC = (\exp(m_A*[\ln(hardness)] + b_A))*CF$$

$$CCC = (\exp(m_C*[\ln(hardness)] + b_C))*CF$$

where CF is the conversion factor used for converting a metal criterion expressed as the total recoverable fraction in the water column to a criterion expressed as the dissolved fraction in the water column.

Chemical	**m_A**	**b_A**	**m_C**	**b_C**
Cadmium	1.0166	-3.924	0.7409	-4.719
Chromium III	0.8190	3.7256	0.8190	0.6848
Copper	0.9422	-1.700	0.8545	-1.702
Lead	1.273	-1.460	1.273	-4.705
Nickel	0.8460	2.255	0.8460	0.0584
Silver	1.72	-6.59		
Zinc	0.8473	0.884	0.8473	0.884

Conversion factors (CF) for dissolved metals (the values for total recoverable metals criteria were multiplied by the appropriate conversion factors shown below to calculate the dissolved metals criteria):

Chemical	Freshwater		Saltwater	
	Acute	Chronic	Acute	Chronic
Arsenic	1.000	1.000	1.000	1.000
Cadmium	1.136672-[(ln hardness)(0.041838)]	1.101672-[(ln hardness)(0.041838)]	0.994	0.994
Chromium III	0.316	0.860	--	--
Chromium VI	0.982	0.962	0.993	0.993
Copper	0.960	0.960	0.83	0.83
Lead	1.46203-[(ln hardness)(0.145712)]	1.46203-[(ln hardness)(0.145712)]	0.951	0.951
Nickel	0.998	0.997	0.990	0.990
Selenium	0.996	0.922	0.998	0.998
Silver	0.85	0.85	0.85	--
Zinc	0.978	0.986	0.946	0.946

~~G Human Health criterion is the same as originally published in the 1976 EPA Red Book (Quality Criteria for Water, EPA-440/9-76-023) which predates the 1980 methodology and did not use the fish ingestion BCF approach.~~

~~H This value is based on a Drinking Water regulation.~~

I This value is based on criterion published in Ambient Water Quality Criteria for Endosulfan (EPA 440/5-80-046) and should be applied as the sum of alpha- and beta-endosulfan.

~~J No BCF was available; therefore, this value is based on that published in the 1986 EPA Gold Book.~~

~~K Human Health criterion is for "dissolved" concentration based on the 1976 EPA Red Book conclusion that adverse effects from exposure at this level are aesthetic rather than toxic.~~

~~L This value is expressed as the fish tissue concentration of methylmercury.~~

M Freshwater aquatic life values for pentachlorophenol are expressed as a function of pH, and are calculated as follows: CMC=(exp(1.005(pH)-4.869); CCC=exp(1.005(pH)-5.134).

N This number was assigned to the list of non-priority pollutants in National Recommended Water Quality Criteria: 2002 (EPA-822-R-02-047).

O This criterion is based on EPA recommendations issued in 1980 that were derived using guidelines that differed from EPA's 1985 Guidelines for minimum data requirements and derivation procedures. For example, a "CMC" derived using the 1980 Guidelines was derived to be used as an instantaneous maximum. If assessment is to be done using an averaging period, the values given should be divided by 2 to obtain a value that is more comparable to a CMC derived using the 1985 Guidelines.

P Criterion shown is the minimum (i.e. CCC in water should not be below this value in order to protect aquatic life).

Q Criterion is applied as total arsenic (i.e. arsenic (III) + arsenic (V)).

R Arsenic criterion refers to the inorganic form only.

S This criterion is expressed as µg free cyanide (CN)/L.

T This criterion applies to DDT and its metabolites (i.e. the total concentration of DDT and its metabolites should not exceed this value).

U This criterion applies to total PCBs (e.g. the sum of all congener or all isomer or homolog or Arochlor analyses).

V The CMC=1/[(f1/CMC1)+(f2/CMC2)] where f1 and f2 are the fractions of total selenium that are treated as selenite and selenate, respectively, and CMC1 and CMC2 are 185.9 µg/L and 12.82 µg/L, respectively.

W The acute and chronic criteria for aluminum are 750 µg/L and 87 µg/L, respectively. These values for aluminum are expressed in terms of "total recoverable" concentration of metal in the water column. The criterion applies at pH<6.6 and hardness<12 mg/L (as $CaCO_3$).

X The effective date for the criterion in the column immediately to the left is 1991.

Y No criterion.

Appendix D. Crosswalk Between Effective Human Health Criteria and Proposed Criteria

Compound Name or Class [Table 40 Name, if different] *Criteria denoted in red indicate proposed additions to the human health criteria*	Priority Pollutant	Carcinogen	Concentration in Units Per Liter for Protection of Human Health CURRENT		Concentration in Units Per Liter for Protection of Human Health PROPOSED TABLE 40	
			Water and Fish Ingestion (µg/L)	Fish Consumption Only (µg/L)	Water and Fish Ingestion (µg/L)	Fish Consumption Only (µg/L)
ACENAPTHENE	Y	N	--	--	95	99
ACROLEIN	Y	N	320	780	0.88	0.93
ACRYLONITRILE	Y	Y	0.058	0.65	0.018	0.025
ALDRIN	Y	Y	0.000074	0.000079	0.0000050	0.0000050
ANTHRACENE	N	N	--	--	2900	4000
ANTIMONY	Y	N	146	45,000	5.1	64
ARSENIC	Y	Y	2.1	2.1 (freshwater) 1.0 (saltwater)	2.1	2.1 (freshwater) 1.0 (saltwater)
ASBESTOS	Y	Y	7,000,000 fibers/L	--	7,000,000 fibers/L	--
BARIUM	N	N	1000	--	1000	--
BENZENE	N	Y	0.66	40	0.44	1.4
BENZIDINE	N	Y	0.00012	0.00053	0.000018	0.000020

Compound Name or Class [Table 40 Name, if different] *Criteria denoted in red indicate proposed additions to the human health criteria*	Priority Pollutant	Carcinogen	Concentration in Units Per Liter for Protection of Human Health CURRENT		Concentration in Units Per Liter for Protection of Human Health PROPOSED TABLE 40	
			Water and Fish Ingestion (µg/L)	Fish Consumption Only (µg/L)	Water and Fish Ingestion (µg/L)	Fish Consumption Only (µg/L)
BENZ(A) ANTHRACENE	N	Y	--	--	0.0013	0.0018
BENZO(A)PYRENE	N	Y	--	--	0.0013	0.0018
BENZO(B)FLUORANTHENE 3,4	N	Y	--	--	0.0013	0.0018
BENZO(K)FLUORANTHENE	N	Y	--	--	0.0013	0.0018
BROMOFORM	N	Y	--	--	3.3	14
BUTYLBENZYL PHTHALATE	N	N	--	--	190	190
CARBON TETRACHLORIDE	Y	Y	0.4	6.94	0.10	0.16
CHLORDANE	Y	Y	0.00046	0.00048	0.000081	0.000081
CHLORINATED BENZENES [CHLOROBENZENE]	Y	Y	488	--	74	160
CHLORODIBROMOMETHANE	N	Y	--	--	0.31	1.3
CHLOROETHYL ETHER (BIS-2)	Y	Y	0.03	1.36	0.020	0.05
CHLOROFORM	Y	Y	0.19	15.7	260	1100
CHLOROISOPROPYL ETHER (BIS-2)	Y	N	34.7	4360	1200	6500
CHLOROMETHYL ETHER (BIS)	N	Y	0.00000376	0.00184	0.000024	0.000029

Compound Name or Class [Table 40 Name, if different] *Criteria denoted in red indicate proposed additions to the human health criteria*	Priority Pollutant	Carcinogen	Concentration in Units Per Liter for Protection of Human Health CURRENT		Concentration in Units Per Liter for Protection of Human Health PROPOSED TABLE 40	
			Water and Fish Ingestion (µg/L)	Fish Consumption Only (µg/L)	Water and Fish Ingestion (µg/L)	Fish Consumption Only (µg/L)
CHLORONAPHTHALENE 2	N	N	--	--	150	160
CHLOROPHENOL 2	Y	N	--	--	14	15
CHLOROPHENOXY HERBICIDES (2,4,5,-TP)	N	N	10	--	10	--
CHLOROPHENOXY HERBICIDES (2,4-D)	N	N	100	--	100	--
CHRYSENE	N	Y	--	--	0.0013	0.0018
COPPER	Y	N	1300	--	1300	--
CYANIDE	Y	N	200	--	130	130
DDT [DDT 4,4']	Y	Y	0.000024	0.000024	0.000022	0.000022
DDD 4, 4'	Y	Y	--	--	0.000031	0.000031
DDE 4, 4'	Y	Y	--	--	0.000022	0.000022
DIBENZO(A,H)ANTHRACENE	N	Y	--	--	0.0013	0.0018
DIBUTYLPHTHALATE [DI-N-BUTYL PHTHALATE]	Y	N	35,000	154,000	400	450

Compound Name or Class [Table 40 Name, if different] *Criteria denoted in red indicate proposed additions to the human health criteria*	Priority Pollutant	Carcinogen	Concentration in Units Per Liter for Protection of Human Health CURRENT		Concentration in Units Per Liter for Protection of Human Health PROPOSED TABLE 40	
			Water and Fish Ingestion (µg/L)	Fish Consumption Only (µg/L)	Water and Fish Ingestion (µg/L)	Fish Consumption Only (µg/L)
DICHLOROBENZENES [DICHLOROBENZENE(O)1,2]	Y	N	400	2,600	110	130
DICHLOROBENZENE(P) 1,4	N	N	--	--	16	19
DICHLOROBENZIDINE [DICHLOROBENZIDINE 3,3']	Y	Y	0.01	0.020	0.0027	0.0028
DICHLOROBROMOMETHANE	N	Y	--	--	0.42	1.7
DICHLOROETHANE 1,2	Y	Y	0.94	243	0.35	3.7
DICHLOROETHYLENES [DICHLOROETHYLENE 1,1]	Y	Y	0.033	1.85	230	710
DICHLOROETHYLENE TRANS 1,2	N	N	--	--	120	1000
DICHLOROPHENOL 2,4	N	N	3,090	--	23	29
DICHLOROPROPANE [DICHLOROPROPANE 1,2]	Y	N	--	--	0.38	1.5
DICHLOROPROPENE [DICHLOROPROPENE 1,3]	Y	N	87	14,100	0.30	2.1
DIELDRIN	Y	Y	0.000071	0.000076	0.0000053	0.0000054

Compound Name or Class [Table 40 Name, if different] *Criteria denoted in red indicate proposed additions to the human health criteria*	Priority Pollutant	Carcinogen	Concentration in Units Per Liter for Protection of Human Health CURRENT		Concentration in Units Per Liter for Protection of Human Health PROPOSED TABLE 40	
			Water and Fish Ingestion (µg/L)	Fish Consumption Only (µg/L)	Water and Fish Ingestion (µg/L)	Fish Consumption Only (µg/L)
DIETHYLPHTHALATE	Y	N	350,000	1,800,000	3800	4400
DIMETHYL PHENOL 2,4	Y	N	--	--	76	85
DIMETHYL PHTHALATE	Y	N	313,000	2,900,000	84,000	110,000
DINITROPHENOL 2,4	Y	N	--	--	62	530
DINITROPHENOLS	Y	N	--	--	62	530
DINITROTOLUENE 2,4	N	Y	0.11	9.1	0.084	0.34
DINITROTOLUENE	Y	N	70	14,300	No criteria	No criteria
DINITRO-O-CRESOL 2,4	Y	N	13.4	765	No criteria	No criteria
DIOXIN (2,3,7,8-TCDD)	Y	Y	0.000000013	0.000000014	0.00000000051	0.00000000051
DIPHENYLHYDRAZINE	Y	N	0.042	0.56	No criteria	No criteria
DIPHENYLHYDRAZINE 1,2	Y	N	--	--	0.014	0.02
DI-2-ETHYLHEXYL PHTHALATE [BIS-2-ETHYLHEXYL PHTHALATE]	Y	N	15,000	50,000	0.20	0.22
ENDOSULFAN	Y	N	74	159	--	--
ENDOSULFAN ALPHA	Y	N	--	--	8.5	8.9

Compound Name or Class [Table 40 Name, if different] *Criteria denoted in red indicate proposed additions to the human health criteria*	Priority Pollutant	Carcinogen	Concentration in Units Per Liter for Protection of Human Health CURRENT		Concentration in Units Per Liter for Protection of Human Health PROPOSED TABLE 40	
			Water and Fish Ingestion (µg/L)	Fish Consumption Only (µg/L)	Water and Fish Ingestion (µg/L)	Fish Consumption Only (µg/L)
ENDOSULFAN BETA	Y	N	--	--	8.5	8.9
ENDOSULFAN SULFATE	Y	N	--	--	8.5	8.9
ENDRIN	Y	N	1	--	0.024	0.024
ENDRIN ALDEHYDE	Y	N	--	--	0.03	0.03
ETHYLBENZENE	Y	N	1,400	3,280	160	210
FLUORANTHENE	Y	N	42	54	14	14
FLUORENE	Y	N	--	--	390	530
HALOMETHANES	Y	Y	0.19	15.7	No criteria	No criteria
HEPTACHLOR	Y	Y	0.00028	0.00029	0.0000079	0.0000079
HEPTACHLOR EPOXIDE	Y	Y	--	--	0.0000039	0.0000039
HEXACHLOROETHANE	N	Y	1.9	8.74	0.29	0.33
HEXACHLOROBENZENE	Y	N	0.00072	0.00074	0.000029	0.000029
HEXACHLOROBUTADIENE	Y	Y	0.45	50	0.36	1.8

Compound Name or Class [Table 40 Name, if different] *Criteria denoted in red indicate proposed additions to the human health criteria*	**Priority Pollutant**	**Carcinogen**	**Concentration in Units Per Liter for Protection of Human Health CURRENT**		**Concentration in Units Per Liter for Protection of Human Health PROPOSED TABLE 40**	
			Water and Fish Ingestion (µg/L)	**Fish Consumption Only (µg/L)**	**Water and Fish Ingestion (µg/L)**	**Fish Consumption Only (µg/L)**
HEXACHLOROCYCLOHEXANE-ALPHA [BHC ALPHA]	Y	Y	0.0092	0.031	0.00045	0.00049
HEXACHLOROCYCLOHEXANE-BETA [BHC BETA]	Y	Y	0.0163	0.0547	0.0016	0.0017
HEXACHLOROCYCLOHEXANE-GAMA [BHC GAMMA (LINDANE)]	Y	Y	0.0186	0.0625	0.17	0.18
HEXACHLOROCYCLOHEXANE-TECHNICAL	Y	Y	0.0123	0.0414	0.0014	0.0015
HEXACHLOROCYCLOPENTADIENE	Y	N	206	--	30	110
INDENO(1,2,3-CD)PYRENE	Y	Y	--	--	0.0013	0.0018
ISOPHORONE	Y	N	5,200	520,000	27	96
MANGANESE	N	N	--	100	--	100
METHOXYCHLOR	N	N	100	--	100	--
METHYL BROMIDE	Y	N	--	--	37	150

Compound Name or Class [Table 40 Name, if different] *Criteria denoted in red indicate proposed additions to the human health criteria*	Priority Pollutant	Carcinogen	Concentration in Units Per Liter for Protection of Human Health CURRENT		Concentration in Units Per Liter for Protection of Human Health PROPOSED TABLE 40	
			Water and Fish Ingestion (µg/L)	Fish Consumption Only (µg/L)	Water and Fish Ingestion (µg/L)	Fish Consumption Only (µg/L)
METHYL-4,6-DINITROPHENOL 2	Y	N	--	--	9.2	28
METHYLENE CHLORIDE	Y	Y	--	--	4.3	59
METHYLMERCURY (MG/KG)	Y	N	--	--	--	0.040
MONOCHLOROBENZENE	Y	N	488	--	No criteria	No criteria
NICKEL	Y	N	13.4	100	140	170
NITRATES	N	N	10,000	--	10,000	--
NITROBENZENE	Y	N	19,800	--	14	69
NITROSAMINES	Y	Y	0.0008	1.24	0.00079	0.046
NITROSODIBUTYLAMINE N	Y	Y	0.0064	0.587	0.0050	0.02
NITROSODIETHYLAMINE N	Y	Y	0.0008	1.24	0.00079	0.046
NITROSODIMETHYLAMINE N	Y	Y	0.0014	16	0.00068	0.30
NITROSODI-N-PROPYLAMINE, N	Y	Y	--	--	0.0046	0.051
NITROSODIPHENYLAMINE N	Y	Y	4.9	16.1	0.55	0.60
NITROSOPYRROLIDINE N	Y	Y	0.016	91.9	0.016	3.4

Compound Name or Class [Table 40 Name, if different] *Criteria denoted in red indicate proposed additions to the human health criteria*	Priority Pollutant	Carcinogen	Concentration in Units Per Liter for Protection of Human Health CURRENT		Concentration in Units Per Liter for Protection of Human Health PROPOSED TABLE 40	
			Water and Fish Ingestion (µg/L)	Fish Consumption Only (µg/L)	Water and Fish Ingestion (µg/L)	Fish Consumption Only (µg/L)
PCBS	Y	Y	0.000079	0.000079	0.0000064	0.0000064
PENTACHLOROBENZENE	N	N	74	85	0.15	0.15
PENTACHLOROPHENOL	Y	N	1,010	--	0.15	0.30
PHENOL	Y	N	3,500	--	9,400	86,000
POLYNUCLEAR AROMATIC HYDROCARBONS	Y	Y	0.0028	0.0311	No criteria	No criteria
PYRENE	Y	N	--	--	290	400
SELENIUM	Y	N	10	--	120	420
TETRACHLOROBENZENE 1,2,4,5	Y	N	38	48	0.11	0.11
TETRACHLOROETHANE 1,1,2,2	Y	Y	0.17	10.7	0.12	0.40
TETRACHLOROETHYLENE	Y	Y	0.8	8.85	0.24	0.33
THALLIUM	Y	N	13	48	0.043	0.047
TOLUENE	Y	N	14,300	424,000	720	1500
TOXAPHENE	Y	Y	0.00071	0.00073	0.000028	0.000028
TRICHLOROBENZENE 1,2,4	Y	N	--	--	6.4	7.0

Compound Name or Class [Table 40 Name, if different] *Criteria denoted in red indicate proposed additions to the human health criteria*	**Priority Pollutant**	**Carcinogen**	**Concentration in Units Per Liter for Protection of Human Health CURRENT**		**Concentration in Units Per Liter for Protection of Human Health PROPOSED TABLE 40**	
			Water and Fish Ingestion (µg/L)	**Fish Consumption Only (µg/L)**	**Water and Fish Ingestion (µg/L)**	**Fish Consumption Only (µg/L)**
TRICHLOROETHANE 1,1,2	Y	Y	0.6	41.8	0.44	1.6
TRICHLOROETHYLENE	Y	Y	2.7	80.7	1.4	3.0
TRICHLOROPHENOL 2,4,5	N	N	2,600	--	330	360
TRICHLOROPHENOL 2,4,6	Y	Y	1.2	3.6	0.23	0.24
VINYL CHLORIDE	Y	Y	2	525	0.02	0.24
ZINC	Y	N	--	--	2100	2600

Appendix E. TABLE 40: Human Health Water Quality Criteria for Toxic Pollutants

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Human Health Criteria Summary

The concentration for each pollutant listed in Table 40 was derived to protect Oregonians from potential adverse health impacts associated with long-term exposure to toxic substances associated with consumption of fish, shellfish, and water. The "organism only" criteria are established to protect fish and shellfish consumption and apply to waters of the state designated for fishing. The "water + organism" criteria are established to protect the consumption of drinking water, fish, and shellfish, and apply where both fishing and domestic water supply (public and private) are designated uses. All criteria are expressed as micrograms per liter (µg/L), unless otherwise noted. Pollutants are listed in alphabetical order. Additional information includes the Chemical Abstract Service (CAS) number, whether the criterion is based on carcinogenic effects (can cause cancer in humans), and whether there is an aquatic life criterion for the pollutant (i.e. "y"= yes, "n" = no). All the human health criteria were calculated using a fish consumption rate of 175 grams per day unless otherwise noted. A fish consumption rate of 175 grams per day is approximately equal to 23 8-ounce fish meals per month. For pollutants categorized as carcinogens, values represent a cancer risk of one additional case of cancer in one million people (i.e. 10^{-6}), unless otherwise noted. All metals criteria are for total metal concentration, unless otherwise noted. Italicized pollutants represent non-priority pollutants. The human health criteria revisions established by OAR 340-041-0033 and shown in Table 40 do not become applicable for purposes of ORS chapter 468B or the federal Clean Water Act until approved by EPA pursuant to 40 CFR 131.21 (4/27/2000).

No.	Pollutant	CAS No.	Carcinogen	Aquatic Life Criterion	*Human Health Criteria for the Consumption of:*	
					Water + Organism (µg/L)	Organism Only (µg/L)
1	Acenaphthene	83329	n	n	95	99
2	Acrolein	107028	n	n	0.88	0.93
3	Acrylonitrile	107131	y	n	0.018	0.025
4	Aldrin	309002	y	y	0.0000050	0.0000050
5	Anthracene	120127	n	n	2900	4000
6	Antimony	7440360	n	n	5.1	64
7	Arsenic (inorganic)[A]	7440382	y	n	2.1	2.1(freshwater) 1.0 (saltwater)
	[A] The arsenic criteria are expressed as total inorganic arsenic. The "organism only" criteria are based on a risk level of approximately of 1.1 x 10^{-5}, and the "water + organism" criterion is based on a risk level of 1 x 10^{-4}					
8	Asbestos[B]	1332214	y	n	7,000,000 fibers/L	--
	[B] The human health risks from asbestos are primarily from drinking water, therefore no "organism only" criterion was developed. The "water + organism" criterion is based on the Maximum Contaminant Level (MCL) established under the Safe Drinking Water Act.					
9	*Barium*[C]	7440393	n	n	1000	--
	[C] The human health criterion for barium is the same as originally published in the 1976 EPA Red Book which predates the 1980 methodology and did not utilize the fish ingestion BCF approach. This same criterion value was also published in the 1986 EPA Gold Book. Human health risks are primarily from drinking water, therefore no "organism only" criterion was developed. The "water + organism" criterion is based on the Maximum Contaminant Level (MCL) established under the Safe Drinking Water Act.					
10	Benzene	71432	y	n	0.44	1.4
11	Benzidine	92875	y	n	0.000018	0.000020
12	Benz(a)anthracene	56553	y	n	0.0013	0.0018
13	Benzo(a)pyrene	50328	y	n	0.0013	0.0018
14	Benzo(b)fluoranthene 3,4	205992	y	n	0.0013	0.0018
15	Benzo(k)fluoranthene	207089	y	n	0.0013	0.0018
16	BHC Alpha	319846	y	n	0.00045	0.00049
17	BHC Beta	319857	y	n	0.0016	0.0017
18	BHC Gamma (Lindane)	58899	n	y	0.17	0.18
19	Bromoform	75252	y	n	3.3	14
20	Butylbenzyl Phthalate	85687	n	n	190	190
21	Carbon Tetrachloride	56235	y	n	0.10	0.16
22	Chlordane	57749	y	y	0.000081	0.000081
23	Chlorobenzene	108907	n	n	74	160
24	Chlorodibromomethane	124481	y	n	0.31	1.3
25	Chloroethyl Ether bis 2	111444	y	n	0.020	0.05
26	Chloroform	67663	n	n	260	1100
27	Chloroisopropyl Ether bis 2	108601	n	n	1200	6500
28	*Chloromethyl ether, bis*	542881	y	n	0.000024	0.000029
29	Chloronaphthalene 2	91587	n	n	150	160
30	Chlorophenol 2	95578	n	n	14	15
31	*Chlorophenoxy Herbicide (2,4,5,-TP)*[D]	93721	n	n	10	--
	[D] The Chlorophenoxy Herbicide (2,4,5,-TP) criterion is the same as originally published in the 1976 EPA Red Book which predates the 1980 methodology and did not utilize the fish ingestion BCF approach. This same criterion value was also published in the 1986 EPA Gold Book. Human health risks are primarily from drinking water, therefore no "organism only" criterion was developed. The "water + organism" criterion is based on the Maximum Contaminant Level (MCL) established					

No.	Pollutant	CAS No.	Carcinogen	Aquatic Life Criterion	Human Health Criteria for the Consumption of:	
					Water + Organism (µg/L)	Organism Only (µg/L)
	under the Safe Drinking Water Act.					
32	*Chlorophenoxy Herbicide (2,4-D)* [E]	94757	n	n	100	--
	[E] *The Chlorophenoxy Herbicide (2,4-D) criterion is the same as originally published in the 1976 EPA Red Book which predates the 1980 methodology and did not utilize the fish ingestion BCF approach. This same criterion value was also published in the 1986 EPA Gold Book. Human health risks are primarily from drinking water, therefore no "organism only" criterion was developed. The "water + organism" criterion is based on the Maximum Contaminant Level (MCL) established under the Safe Drinking Water Act.*					
33	Chrysene	218019	y	n	0.0013	0.0018
34	Copper [F]	7440508	n	y	1300	--
	[F] *Human health risks from copper are primarily from drinking water, therefore no "organism only" criterion was developed. The "water + organism" criterion is based on the Maximum Contaminant Level (MCL) established under the Safe Drinking Water Act.*					
35	Cyanide [G]	57125	n	y	130	130
	[G] *The cyanide criterion is expressed as total cyanide (CN)/L.*					
36	DDD 4,4'	72548	y	n	0.000031	0.000031
37	DDE 4,4'	72559	y	n	0.000022	0.000022
38	DDT 4,4'	50293	y	y	0.000022	0.000022
39	Dibenz(a,h)anthracene	53703	y	n	0.0013	0.0018
40	Dichlorobenzene(m) 1,3	541731	n	n	80	96
41	Dichlorobenzene(o) 1,2	95501	n	n	110	130
42	Dichlorobenzene(p) 1,4	106467	n	n	16	19
43	Dichlorobenzidine 3,3'	91941	y	n	0.0027	0.0028
44	Dichlorobromomethane	75274	y	n	0.42	1.7
45	Dichloroethane 1,2	107062	y	n	0.35	3.7
46	Dichloroethylene 1,1	75354	n	n	230	710
47	Dichloroethylene trans 1,2	156605	n	n	120	1000
48	Dichlorophenol 2,4	120832	n	n	23	29
49	Dichloropropane 1,2	78875	y	n	0.38	1.5
50	Dichloropropene 1,3	542756	y	n	0.30	2.1
51	Dieldrin	60571	y	y	0.0000053	0.0000054
52	Diethyl Phthalate	84662	n	n	3800	4400
53	Dimethyl Phthalate	131113	n	n	84000	110000
54	Dimethylphenol 2,4	105679	n	n	76	85
55	Di-n-butyl Phthalate	84742	n	n	400	450
56	Dinitrophenol 2,4	51285	n	n	62	530
57	*Dinitrophenols*	25550587	n	n	62	530
58	Dinitrotoluene 2,4	121142	y	n	0.084	0.34
59	Dioxin (2,3,7,8-TCDD)	1746016	y	n	0.00000000051	0.00000000051
60	Diphenylhydrazine 1,2	122667	y	n	0.014	0.020
61	Endosulfan Alpha	959988	n	y	8.5	8.9
62	Endosulfan Beta	33213659	n	y	8.5	8.9
63	Endosulfan Sulfate	1031078	n	n	8.5	8.9
64	Endrin	72208	n	y	0.024	0.024
65	Endrin Aldehyde	7421934	n	n	0.030	0.030

No.	Pollutant	CAS No.	Carcinogen	Aquatic Life Criterion	Human Health Criteria for the Consumption of:	
					Water + Organism (µg/L)	Organism Only (µg/L)
66	Ethylbenzene	100414	n	n	160	210
67	Ethylhexyl Phthalate bis 2	117817	y	n	0.20	0.22
68	Fluoranthene	206440	n	n	14	14
69	Fluorene	86737	n	n	390	530
70	Heptachlor	76448	y	y	0.0000079	0.0000079
71	Heptachlor Epoxide	1024573	y	y	0.0000039	0.0000039
72	Hexachlorobenzene	118741	y	n	0.000029	0.000029
73	Hexachlorobutadiene	87683	y	n	0.36	1.8
74	*Hexachlorocyclo-hexane-Technical*	608731	y	n	0.0014	0.0015
75	Hexachlorocyclopentadiene	77474	n	n	30	110
76	Hexachloroethane	67721	y	n	0.29	0.33
77	Indeno(1,2,3-cd)pyrene	193395	y	n	0.0013	0.0018
78	Isophorone	78591	y	n	27	96
79	*Manganese* [H]	7439965	n	n	--	100
	[H] *The "fish consumption only" criterion for manganese applies only to salt water and is for total manganese. This EPA recommended criterion predates the 1980 human health methodology and does not utilize the fish ingestion BCF calculation method or a fish consumption rate.*					
80	*Methoxychlor* [I]	72435	n	y	100	--
	[I] *The human health criterion for methoxychlor is the same as originally published in the 1976 EPA Red Book which predates the 1980 methodology and did not utilize the fish ingestion BCF approach. This same criterion value was also published in the1986 EPA Gold Book. Human health risks are primarily from drinking water, therefore no "organism only" criterion was developed. The "water + organism" criterion is based on the Maximum Contaminant Level (MCL) established under the Safe Drinking Water Act.*					
81	Methyl Bromide	74839	n	n	37	150
82	Methyl-4,6-dinitrophenol 2	534521	n	n	9.2	28
83	Methylene Chloride	75092	y	n	4.3	59
84	Methylmercury (mg/kg) [J]	22967926	n	n	--	0.040 mg/kg
	[J] *This value is expressed as the fish tissue concentration of methylmercury. Contaminated fish and shellfish is the primary human route of exposure to methylmercury*					
85	Nickel	7440020	n	n	140	170
86	*Nitrates* [K]	14797558	n	n	10000	--
	[K] *The human health criterion for nitrates is the same as originally published in the 1976 EPA Red Book which predates the 1980 methodology and did not utilize the fish ingestion BCF approach. This same criterion value was also published in the 1986 EPA Gold Book. Human health risks are primarily from drinking water, therefore no "organism only" criterion was developed. The "water + organism" criterion is based on the Maximum Contaminant Level (MCL) established under the Safe Drinking Water Act.*					
87	Nitrobenzene	98953	n	n	14	69
88	*Nitrosamines*	35576911	y	n	0.00079	0.046
89	*Nitrosodibutylamine, N*	924163	y	n	0.0050	0.022
90	*Nitrosodiethylamine, N*	55185	y	n	0.00079	0.046
91	Nitrosodimethylamine, N	62759	y	n	0.00068	0.30
92	Nitrosodi-n-propylamine, N	621647	y	n	0.0046	0.051
93	Nitrosodiphenylamine, N	86306	y	n	0.55	0.60
94	*Nitrosopyrrolidine, N*	930552	y	n	0.016	3.4
95	*Pentachlorobenzene*	608935	n	n	0.15	0.15
96	Pentachlorophenol	87865	y	y	0.15	0.30

No.	Pollutant	CAS No.	Carcinogen	Aquatic Life Criterion	*Human Health Criteria for the Consumption of:*	
					Water + Organism (µg/L)	Organism Only (µg/L)
97	Phenol	108952	n	n	9400	86000
98	Polychlorinated Biphenyls (PCBs)[L]	NA	y	y	0.0000064	0.0000064
	[L] *This criterion applies to total PCBs (e.g. determined as Aroclors or congeners).*					
99	Pyrene	129000	n	n	290	400
100	Selenium	7782492	n	n	120	420
101	*Tetrachlorobenzene, 1,2,4,5-*	95943	n	n	0.11	0.11
102	Tetrachloroethane 1,1,2,2	79345	y	n	0.12	0.40
103	Tetrachloroethylene	127184	y	n	0.24	0.33
104	Thallium	7440280	n	n	0.043	0.047
105	Toluene	108883	n	n	720	1500
106	Toxaphene	8001352	y	y	0.000028	0.000028
107	Trichlorobenzene 1,2,4	120821	n	n	6.4	7.0
108	Trichloroethane 1,1,2	79005	y	y	0.44	1.6
109	Trichloroethylene	79016	y	n	1.4	3.0
110	Trichlorophenol 2,4,6	88062	y	n	0.23	0.24
111	*Trichlorophenol, 2, 4, 5-*	95954	n	n	330	360
112	Vinyl Chloride	75014	y	n	0.023	0.24
113	Zinc	7440666	n	n	2100	2600