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Part 2 of 2

OREGON

ENVIRONMENTAL QUALITY

COMMISSION MEETING

MATERIALS 08/22/2008

State of Oregon
Department of Environmental Quality

State of Oregon
Department of Environmental Quality Memorandum

Date: August 4, 2008

To: Environmental Quality Commission

From: Dick Pedersen, Director

Subject: Agenda Item O, Informational Item: Oregon's Fish Consumption Rate - For Use in Setting Water Quality Standards for Toxic Pollutants
August 21-22, 2008 EQC Meeting

Purpose of Item

In October 2008, the Department of Environmental Quality will ask the Environmental Quality Commission whether DEQ should conduct rulemaking to revise water quality standards for toxic pollutants based on a recommended fish consumption rate. This informational report and DEQ's associated presentations and discussions are intended to provide information relevant to this upcoming request.

Oregonians may be exposed to toxic pollutants through the fish we eat and the water we drink. Oregon's water quality standards contain human health criteria, which are designed to protect human health from toxic pollutants that may occur in surface waters and may accumulate in fish. A key component of the human health criteria is the fish consumption rate, which is intended to reflect how much fish people eat. In order to set standards that protect Oregonians, DEQ must determine how much fish people in Oregon eat. The EQC adopts these standards for Oregon's surface waters.

DEQ, the U.S. Environmental Protection Agency and the Confederated Tribes of the Umatilla Indian Reservation have collaborated on the Oregon Fish Consumption Rate project. This report provides an overview of this effort, including information on:

- the process used for discussions about fish consumption;
- fish consumption patterns in Oregon and the Pacific Northwest;
- how a revised fish consumption rate will affect water quality criteria for human health;
- estimated economic impacts; and
- potential implementation approaches.

This report also describes the three governments' initial draft recommended fish consumption rate.

Background

Fish Consumption Rate and Water Quality Standards

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. The criteria help to ensure that people may eat fish and shellfish (from here forward referred to as "fish") from local waters without fear of incurring unacceptable health risks.

In 2004, the EQC, at DEQ's recommendation, adopted EPA's 2002 recommended toxic pollutants criteria for aquatic life and for human health. These human health criteria were based on a fish consumption rate of 17.5 grams per day (g/d), which represents a national average. Prior to that time, DEQ's criteria were based on EPA's 1986 recommended criteria and a fish consumption rate of 6.5 g/d. 17.5 grams per day 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 EQC requested that DEQ seek resources to conduct a study of fish consumption rates in Oregon.

Following DEQ's 2004 adoption of EPA's 2002 criteria, concerns about Oregon's criteria heightened. Native American tribal governments objected to the criteria, stating that the criteria do 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 have been most involved in the FCR process to date include the Umatilla, Warm Springs, Klamath, Siletz and Grand Ronde tribes.

Although DEQ's 2004 criteria follow EPA's guidance document for the development of human health criteria (referred to as the "Human Health Methodology," 2000), which recommends using 17.5 g/d as a default value, the guidance document also recommends using local fish consumption data when it is available. In this circumstance, local data are available from a study conducted by the Columbia River Inter-Tribal Fish Commission (CRITFC, 1994), which included surveys of two Tribes that reside in Oregon, the Confederated Tribes of the Umatilla Indian Reservation and the Confederated Tribes of the Warms Springs Reservation. Hence, EPA has expressed concerns about, and has not yet approved DEQ's 2004 criteria. EPA's approval is required under the federal CWA because, although DEQ's 2004 criteria reflect an increase in the fish consumption rate from 6.5 g/d to 17.5 g/d, some of the 2004 criteria are actually less stringent than Oregon's previous criteria due to updated scientific information affecting other factors that go into calculating human health criteria.

Fish Consumption Rate Review Project

For the above reasons and with the recognition that many Oregonians eat more than an average of 17.5 g/d of fish and shellfish, DEQ embarked on this 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 is based on available literature and data.

Because of the interest and roles of the state, federal and tribal governments, EPA, the Umatilla Tribes and DEQ have collaborated on the project throughout the process and intend to bring a joint recommendation to the EQC in October. Currently, the three governments are coalescing around 175 g/d as a recommended fish consumption rate. See "Key Issues" below for further discussion.

The fish consumption rate review project was launched in the fall of 2006. The process included seven workshops. 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. Please see Attachment A for information on the public workshops.

Human Health Focus Group

DEQ formed two workgroups, the Human Health Focus Group and the Fiscal Impact and Implementation Advisory Committee, 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 to use as the scientific basis for choosing a consumption rate. The group wrote a report summarizing the science and made recommendations about the quality and appropriate use of the available information. This report is provided in Attachment B.

Fiscal Impact and Implementation Concerns

The Fiscal Impact and Implementation Advisory Committee is comprised of individuals representing regulated parties, economists and other affected parties who were assembled to assist DEQ in evaluating the potential economic impacts of revised human health criteria in Oregon. The state Administrative Procedures Act requires particular focus on the costs of compliance to businesses when developing or revising rules. In addition, the FIIAC helped DEQ explore possible implementation strategies and alternatives for situations where cities and/or industry can not attain new stringent standards with current technologies or without causing severe economic hardship. Additional information on the FIIAC may be found in Attachments C and D.

An EPA contractor, Science Applications International Corporation of Reston, Virginia, analyzed the costs of compliance with criteria based on a range of fish consumption rates. A PowerPoint presentation on the SAIC report and the Executive Summary are in Attachments E and F. The full report may be found at http://www.deq.state.or.us/wq/standards/docs/toxics/ORToxicsComplianceCost.pdf.

Project Timelines

With this informational agenda item, the three governments are providing the EQC a summary of the information assembled through this process, the rationale for the three governments' likely recommendation of 175 g/d as the new fish consumption rate and an opportunity for discussion and answering questions. In October 2008, DEQ will ask the EQC to decide whether staff should move forward with rulemaking to revise our human health criteria for toxic pollutants and, if so, what fish consumption rate DEQ should use as the basis for the revised criteria.

The timeline for this project is sensitive. A consent decree between Northwest Environmental Advocates and EPA requires EPA to approve or disapprove Oregon's 2004 criteria by January 2009. However, if by October 30, 2008, the EQC directs DEQ to undergo rulemaking to revise the criteria, the parties may agree to extend the date for EPA action. The consent decree is a result of litigation brought against EPA due to lack of action on DEQ's 2004 criteria. In addition, because many of DEQ's 2004 criteria are not in effect until EPA approves them, Oregon has been in a state of regulatory uncertainty for some time. While it is important to thoroughly consider the consequences of a potential revision to the human health criteria based on a new fish consumption rate, it would benefit DEQ and others to resolve the issue without undue delay.

Once the EQC directs DEQ to move forward with rulemaking, staff estimates it will take approximately ten months to develop rule language, conduct the rulemaking process and propose final rules to the Commission for adoption. An estimated rulemaking schedule is provided in Attachment G.

Key Issues

Key issues include:

- choosing an appropriate fish consumption rate as the basis for Oregon's human health criteria for toxic pollutants;
- the potential economic impacts resulting from revised criteria; and
- identifying environmentally meaningful approaches for implementing the revised criteria.

Choosing An Appropriate Fish Consumption Rate

A major policy decision inherent in developing human health criteria is whether to base the criteria on a fish consumption rate that represents Oregonians who eat large amounts of fish and shellfish for cultural, economic, health or other reasons, or whether to use the average or per capita consumption rate of the 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.

The 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 from this exposure to contaminants and those who eat less will have less risk. As the fish consumption rate increases, the water quality criteria will decrease and the costs to meet the 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 consumption rate will not necessarily result in a ten-fold decrease for all criteria; the change in the criteria will vary by pollutant.

DEQ believes that the Oregon public values having water clean enough to support moderate to high levels of fish consumption, whether it be for cultural, health, economic or other reasons, without incurring unacceptable health risks due to the presence of contaminants in those fish.

DEQ, EPA and the Umatilla Tribes believe that 175 g/d would be a reasonable and protective fish consumption rate to use as the basis for Oregon's human health criteria (See Attachment H for additional information). 175 g/d equals approximately 6.2 ounces per day. This equates to approximately 23 fish or shellfish meals (8 ounces per meal) per month. This rate represents the 95th percentile value from the Columbia River Inter-Tribal Fish Commission study (CRITFC, 1994) and is within the range of 90th percentile values from various studies from the Northwest assembled by the HHFG (Attachment B, Table 3, page 28).

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 standards 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 an overall population average, and to include salmon in the rate. (See Attachment B, page 39).

The CRITFC study surveyed members of the Umatilla and Warms Springs tribes in Oregon, as well as the Yakima and Nez Perce Tribes. This is the only study done in Oregon that was determined by the HHFG to be of sufficiently high quality to use as a basis for setting water quality standards (see HHFG Report, Attachment B, page 7). Other high quality studies in the Northwest show that there are multiple groups of people in the Northwest who eat high amounts of fish and shellfish and that given access to these resources, some people will utilize them.

Inclusion of Salmon and Marine Fish

One issue discussed during this process was whether to include salmon (an anadromous fish) and/or marine fish in the consumption rate. The HHFG recommended that DEQ include salmon and marine fish in our 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. Other interested parties generally seem to support this recommendation.

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. The recommended rate of 175 g/d represents a compromise on this issue as it includes anadromous fish (salmon and lamprey) but not marine species or shellfish.

The HHFG evaluated an alternative approach allowed by EPA to account for exposure from salmon and marine fish consumption, referred to as the relative source contribution (RSC) factor. The HHFG felt that the RSC factor approach was not sufficiently defined and had a high degree of uncertainty. In addition, the RSC approach only modifies those criteria based on non-cancer effects, whereas the fish consumption rate modifies all the criteria, including those based on carcinogenic and non-carcinogenic effects.

Another question raised during this review was whether Oregon should use different fish consumption rates for basins or water bodies that reflect consumption patterns in those areas. DEQ does not recommend using different consumption rates for different geographic areas within the State. The reasons for this include:

- 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 (i.e. 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.

Economic Impacts Resulting From Revised Criteria

On behalf of DEQ, EPA contracted with Science Applications International Corporation (SAIC), to conduct an analysis of the incremental added cost to regulated parties to comply with revised human health criteria based on a range of fish consumption rates being considered in Oregon (See Attachment F for an executive summary of this report). The majority of the report is focused on the costs to NPDES permit holders to meet water quality based effluent limits based on new, more stringent criteria. The currently effective criteria (Tables 33A and 20) were used as the baseline condition.

Based on limited resources and data, SAIC based their analysis on a sample of 17 major Oregon facilities and extrapolated those estimated costs to the larger universe of major municipal and major industrial permitted facilities by category. The contractor also looked at one minor municipal and two minor industrial dischargers and found either that no additional costs would be incurred for the minor facilities based on current data (one industrial) or that there was insufficient data available to do the analysis.

SAIC found that the costs to meet the baseline or currently effective criteria are far greater than the incremental costs of meeting more stringent criteria. The incremental additional costs of meeting criteria based on a fish consumption rate of 175 g/d is estimated to be $350,000 to $450,000 per year statewide if inflow and infiltration costs to prevent an inflow of arsenic from groundwater are not included. However, the costs to meet the baseline criteria were $3.6 to 3.9 million per year without inflow and infiltration controls. See Exhibit ES-1 in Attachment F.

In deriving these estimates, SAIC assumed that DEQ would regulate point sources to the quantification limit when criteria are below that limit and also assumed that in some cases, DEQ would employ implementation measures other than end of pipe treatment technologies, such as toxics reduction programs and variances. SAIC based its assumptions on the experiences of other states, including California and the Great Lakes states, which have significant experience implementing human health criteria in permits.

Environmentally Meaningful Implementation of Revised Criteria

Regulated parties have expressed concern about whether they will be able to comply with more stringent criteria without causing severe economic hardship, or whether it is even technologically feasible to do so. Those who are concerned about improving water quality and reducing risks from eating fish would like to ensure that toxic pollutants in Oregon waters are actually reduced or eliminated, and that sources do whatever they can to reduce their pollutant levels. Therefore, a significant policy issue and point of discussion during this project has been to identify the implementation approaches DEQ could use to ensure that toxic

pollutant control and reduction efforts occur in the most environmentally meaningful, cost-effective and equitable manner possible, without causing severe or widespread economic hardship.

DEQ, EPA the Umatilla Tribes and the FIIAC have been investigating various implementation strategies and approaches that are legally defensible under the Clean Water Act, used in other states, and would provide alternatives where end-of-pipe treatment technologies are either unavailable or prohibitively expensive. DEQ, EPA and members of the FIIAC agree that in some circumstances, dischargers will not be able to meet end-of-pipe water quality-based effluent limits based on the revised criteria using available treatment technologies. When these circumstances occur, alternative implementation strategies should be employed to ensure that the sources reduce their toxic pollutant loads to the maximum extent practicable, in the most cost-effective manner available that does not cause severe or widespread economic harm.

Some of the implementation tools under consideration include: compliance schedules, enhanced pretreatment, source reduction programs, offsets/trading, intake credits and variances. The cost estimates provided in the SAIC report (Attachment F) assume the use of these implementation tools in some circumstances.

One issue under discussion is how DEQ will apply criteria that are below quantification and/or detection limits. DEQ's current Reasonable Potential Analysis procedures address this issue to some extent. DEQ will need to evaluate whether the existing Internal Management Directive sufficiently addresses this issue or whether rule language is needed.

Another issue is that for some pollutants, point sources do not significantly contribute to the total amount of the pollution in the water. In some cases, pollutants come from natural background or geologic sources and in other cases, pollutants result predominantly from air deposition or nonpoint sources. In these situations, implementing regulatory tools such as permit limits will not likely significantly reduce pollutant levels in the water. In instances where facilities are taking in pollutants in their source water, DEQ is exploring whether it to give the facility an "intake credit" when calculating an effluent limit. The credit would limit the facility's responsibility to remove pollutants that they did not add to the wastewater, but that were already in their intake water.

Next Steps

In October 2008, DEQ plans to request that the EQC direct DEQ to conduct a formal rulemaking process to revise Oregon's human health criteria for toxic pollutants. DEQ will recommend, in conjunction with the CTUIR and EPA, a fish consumption rate to use as the basis for those revisions.

DEQ will then begin a rulemaking process with the goal of proposing final rules to

the EQC for adoption by August, 2009. DEQ's intent is to calculate the revised criteria and develop implementation tools, write the revised rule language, and propose draft rules for public comment by February 2009. Please see Attachment G for an estimated rulemaking schedule.

EQC Involvement

The EQC will be asked to make a decision on directing DEQ's rulemaking efforts in October 2008, and to consider adopting the proposed rules in mid-2009.

Attachments

- **A.** Draft Summary of DEQ's Public Workshops on the Fish Consumption Rate Project, DS Consulting, July, 2008
- **B.** Report of the Human Health Focus Group, Oregon Fish and Shellfish Consumption Rate Project, May 2008
- **C.** Members of the Fiscal Impact and Implementation Advisory Committee
- **D.** Charter of the Fiscal Impact and Implementation Advisory Committee, March 2008
- **E.** PowerPoint presentation by DEQ staff summarizing "Cost of Compliance with Water Quality Criteria for Toxic Pollutants for Oregon Waters," Science Applications International Corporation, June 2008
- **F.** Executive Summary, "Cost of Compliance with Water Quality Criteria for Toxic Pollutants for Oregon Waters," Science Applications International Corporation, June 2008
- **G.** Estimated DEQ Rulemaking Schedule
- **H.** Summary Points Supporting a Fish Consumption Rate of 175 grams/day

Available On-line or Upon Request

Cost of Compliance with Water Quality Criteria for Toxic Pollutants for Oregon Waters. Science Applications International Corporations. Prepared for DEQ and EPA. June 2008.
http://www.deq.state.or.us/wq/standards/docs/toxics/ORToxicsComplianceCost.pdf

Notes from the Public Workshops written by DS Consulting.

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Oregon Fish Consumption Rate Project

Facilitator's Overview of the Process for the August 2008 EQC Meeting

The following is the initial report from the impartial facilitation team that was selected by EPA, DEQ and CTUIR and paid for by EPA to assist with the discussions amongst the three governments—and between the three governments and the public. This report is intended to provide an overview of the process that has been used to facilitate conversations relevant to whether or not Oregon should raise its fish consumption rate. For more information about the facilitation team used for this work, please see page 5.

Project Description:

The project sponsors brought in an outside, professional facilitation team in November of 2006 to help convene, coordinate and facilitate discussions around water quality standards in Oregon—specifically the human health criteria relating to fish consumption rates. After discussions among the three governments, a two-pronged process was designed:

1) Three Government Collaboration
   - Stated goal: consensus amongst the three on a final recommendation

2) Public Workshops
   - Stated goal: provide opportunity for public input and involvement

Facilitation Team Role:

The facilitation team has consisted of three professionals: a lead facilitator, an alternate facilitator/meeting reporter and a support person. The role of the facilitation team changed based on which prong of the process was in play:

1) Three Government Collaboration

The facilitation team has been coordinating and facilitating the work of the three governments as they discuss issues, plan next steps and collaborate on the overall project. This has involved one to two planning sessions per month with representatives from the three governments. The primary focus of these inter-governmental meetings has been:

- What type of information is needed? From whom?
- What type of input is needed from key core interest groups, the public and 'expert' focus groups?
- Once the information is received, where does the information/input received lead the thinking of the three governments?
- Based on this, what messages need to be sent? To whom, by whom?
- What are the next steps needed to support a legitimate decision by the EQC in October?

2) Public Workshops

Based on answers to questions outlined in (1) above: the facilitation team designed, coordinated and facilitated public sessions that provided an opportunity for a two-way exchange of information. To accomplish this, the team:

- Helped identify a core group of interested organizations/individuals by interviewing people who had been involved in the past DEQ process;
- Communicated with members of this group via telephone and e-mail regarding two-way information and input needs;
- Helped identify members for expert focus groups;
- Designed agendas and formats of workshops or focus group sessions based on input from all sources;
- Facilitated workshops and most focus groups sessions; and
- Drafted meeting summaries and sent them to DEQ for posting on the agency's website.

Process Outcomes:

From January 2007-June 2008, seven workshops and eighteen focus group sessions were held. Of the focus group sessions, twelve were the Human Health Focus Group and six the Fiscal Impacts and Implementation Advisory Committee. In summary:

- Workshops were held in Portland, Coos Bay, Lincoln City and Pendleton.
- 195 people attended the sessions representing 64 different organizations or groups
- Type of input received:
  - Ranged from presentations to active small group dialogues, to large group discussion or reporting and opportunities at all workshops for written comments and oral testimony. Summaries are available on the website for all the public workshops. http://www.deq.state.or.us/wq/standards/fish.htm
- A list of 65 individuals and other interested parties received updates and notification of meetings, web postings and other project related information from the facilitation team. In addition to this list, DEQ maintained a website that allowed people to view information related to the fish consumption rate process and to sign up for notices about related events from DEQ.

What The Facilitation Team Heard:

For starters, the team heard that this is a complex and emotional issue that has the potential to both positively and negatively impact the lives, health and livelihood of countless Oregonians. In addition, there were some key messages or themes that can be drawn out here for comparison.

At the outset and throughout the process, the three Governments stated that they needed the following:

CTUIR	DEQ	EPA
Protect people who eat fish with an implementable standard	An implementable standard that reduces contaminants in fish & protects human health—and results in EPA approval	A regulation that is consistent with the CWA

In addition to the stated needs of the governments, other groups articulated their needs throughout the course of the project. Primarily, these are as follows:

Municipalities need:
An achievable standard that is not cost prohibitive and provides opportunities for innovative pollution prevention with reasonable legal assurances/safety net—plus a more integrated pollution prevention program across source and non-point source boundaries.

Industry needs:
An achievable standard that is not cost prohibitive, has reasonable legal assurances/safety net and, because of these assurances, provides opportunities for innovative pollution prevention.

Tribes need:
An implementable standard that protects people who eat fish and protects the tribal way of life as "fish eaters." Tribes support the idea of an integrated pollution prevention program across source and non-point source boundaries and are willing to help with that integration effort.

Public needs:
Protection for people who eat fish and education for the public about ways to reduce contaminants in fish that are eaten. Attendees are supportive of an integrated pollution prevention program across point source and non-point source boundaries that could reduce contaminants that may be present in Oregon's waterways.

Environmentalists need:
An implementable and enforced standard that reduces contaminants in fish and waterways—plus an innovative, integrated pollution prevention program across source and non-point source boundaries.

What Was Accomplished?

At the end of the public meeting sessions, the three governments received the following to aid in their discussions and decisions related to the fish consumption rate in Oregon:

- A substantial report from the Human Health Focus Group that reviews local, regional and national studies and suggests that a higher fish consumption rate should be used in Oregon, based on northwest information.
- A review and initial report from the Fiscal Impacts and Implementation Advisory Committee related to costs, possible benefits and implementation strategies. Included in this work is a matrix of possible implementation strategies including one strategy that the group supports.
- A comprehensive set of meeting summary notes to review and consider when discussing and making recommendations about the fish consumption rate.
- A list of key people and how to contact them for any additional information or discussions that could aid further work on the fish consumption rate in Oregon.

Conclusion

The Oregon Fish Consumption Rate project, to date, has provided an opportunity for a wide range of people and interests to come together, review information and share perspectives and data about what might work in Oregon. The project has also supported an exchange of ideas and data among the three governments who have, in recent years, struggled to have constructive discussions about how to move forward to solve this tough issue. For this project, the representatives of the three governments worked hard to 'seek to understand, not just to be understood.' They worked hard--with each other and with those who were interested enough to come to the public workshops—to find data, to understand impacts and to test statements that were made about those impacts.

The project may not have been 'perfect' (perfection was challenged by changes in staffing within the governments, difficulties mining needed data to support robust conversations in a meaningful time frame, and the inevitable overlap of meeting dates with other important public conversations), but it certainly provided an open forum for a good and thorough inquiry to occur. Not everyone will agree on the end product of this project. However, the recommendation that will be forwarded to the Environmental Quality Commission in October 2008 will be the result of an honest and open discussion of all the issues raised during the course of the past 18 months.

Respectfully submitted by

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DS Consulting is a woman-owned full service conflict management, mediation and facilitation firm that focuses primarily on aspects of public policy regarding natural and human resources as well as health care issues. Helping participants work together to increase understanding and communication of their interests so they may solve not only "this" issue, but issues that may arise in the future is at the heart of our collaboration and conflict management efforts.

DS Consulting uses a variety of techniques to help clients enhance communication and negotiation effectiveness so they can achieve innovative and satisfying results. We work closely with clients to assess the type of format or service that best meets their needs and their goals. Clients include: local, state, and federal agencies; elected officials; tribal governments; NGO's; large and small businesses; law firms; and community groups. Services include:

- large group facilitation or mediation;
- conflict needs assessment;
- one-on-one coaching;
- dispute systems design;
- negotiation and communication skills training;
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- collaborative problem solving; and
- consensus building.

Donna Silverberg, owner and principal of DS Consulting, has been in the field of mediation, facilitation and consensus building involving local, state, federal and tribal governments, non-profits, businesses and the public since 1988. Her work has included a wide range of issues including endangered species, health care, water resource/quality, human resources, including ADA issues, non-profit planning and management, public health, land-use, and cross cultural.

She is a member of the California State Bar, the Association for Conflict Resolution, the US Institute for Environmental Conflict Resolution's Roster of Mediators, and served on the Oregon Mediation Association board from 1998-2005, three years as President. She served as Governor Kitzhaber's Special Assistant on Dispute Resolution for Natural Resource issues, Acting Director of the Oregon Dispute Resolution Commission (ODRC) and Manager of the ODRC's Public Policy Dispute Resolution Program. She started DS Consulting in 1998.
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DEQ Water Quality Division - Standards and Assessments

Human Health Focus Group
Oregon Fish and Shellfish Consumption Rate Project

June 2008

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This document can be found on the Department's web site at:
(http://www.deq.state.or.us/wq/standards/fishfocus.htm)
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1. INTRODUCTION

Oregon has over 110,000 miles of rivers and streams, more than 6,000 lakes and ponds, and 362 miles of coastal waters (ODEQ 2000). These waters support fish and shellfish species that are consumed by a broad range of Oregonians. Potentially toxic chemicals are found in some Oregon waters (ODEQ 2008). Over time, fish and shellfish may accumulate these pollutants, resulting in a potential risk to the health of people who consume these fish. The magnitude of health risks depends on the amount of fish or shellfish consumed, the level of contamination in the fish and shellfish, and a person's susceptibility to a particular contaminant. The Oregon Department of Human Services (ODHS) has issued numerous fish advisories throughout the state's rivers and reservoirs (ODHS 2007) to protect the health of people who may consume contaminated fish.

For purposes of its regulatory programs, the Oregon Department of Environmental Quality (ODEQ) is responsible for establishing the level of human health protection for Oregonians who consume fish and shellfish from state water bodies. In order to provide adequate protection for Oregonians, ODEQ needs to accurately assess how much fish Oregonians consume and adopt an appropriate fish consumption rate. This fish consumption rate is used with other factors such as chemical toxicity to develop human health-based water quality criteria. These criteria are codified into Oregon law as human health water quality standards (OAR 340-41). These human health water quality standards are used in ODEQ's regulatory programs to establish water quality permit limits, etc.

The purpose of this report is to document the discussion and conclusions of the Human Health Focus Group. The Human Health Focus Group includes Pacific Northwest scientists who were convened to advise the Oregon Fish and Shellfish Consumption Rate Project on technical issues surrounding the selection of fish consumption rates in Oregon. The Fish Consumption Rate Project is a collaborative effort of ODEQ, the U.S. Environmental Protection Agency (EPA), and the Confederated Tribes of the Umatilla Indian Reservation (CTUIR). The purpose of this collaborative effort is to revise ODEQ's current fish consumption rate of 17.5 grams per day (g/day). In addition to the three cooperating agencies the Fish Consumption Rate Project includes a Core Team of about 40 individuals and organizations that are either directly affected by or interested in the outcome of this project.

The Human Health Focus Group members are regional experts with experience in the areas of toxicology, risk assessment, public health, biostatistics, and/or epidemiology. The members of the Human Health Focus Group were selected from nominations received from the Fish Consumption Rate Project's Core Team as well as ODEQ, EPA, and CTUIR. A total of 26 nominations were received and the six members were selected by ODEQ, EPA, and the CTUIR.

1.1 MEMBERS OF THE HUMAN HEALTH FOCUS GROUP

- Patricia Cirone, PhD, Retired Federal Scientist – Affiliate of University of Washington

- Elaine M. Faustman, Ph.D. DABT, Professor and Director, Institute for Risk Analysis and Risk Communication – Department of Environmental and Occupational Health Sciences, University of Washington

- Ken Kauffman, Environmental Health Specialist –Public Health Environmental Toxicology, Oregon Department of Human Services (ODHS)

- Susan MacMillan, Senior Risk Assessor – URS Corporation

- Dave McBride, MS, Toxicologist – Office of Environmental Health Assessments, Division of Environmental Health, Washington State Department of Health

- Joan Rothlein, PhD, Senior Research Associate – Center for Research on Occupational and Environmental Toxicology (CROET), Oregon Health & Science University

1.2 OBJECTIVES FOR THE HUMAN HEALTH FOCUS GROUP

In their advisory role to the Fish Consumption Rate Project, the Human Health Focus Group was asked to address the following three questions:

1) Considering the available local, regional and national information on fish consumption, what is the scientific evidence Oregon should rely on when selecting a fish consumption rate to use in setting water quality criteria?
2) How should salmon be considered in selecting a fish consumption rate and/or setting criteria?
3) To what extent are populations who consume more than the current fish consumption rate of 17.5 g/day at a greater risk for adverse health impacts?

The Human Health Focus Group was asked to review the available scientific evidence that would inform the Fish Consumption Rate Project. The scientific evidence was gathered from existing literature and the expertise of the Human Health Focus Group. Many different fish consumption rate studies are available in the literature. The Human Health Focus Group chose a subset of relevant studies to assess more comprehensively as well as provide a manageable summary of information.

The Human Health Focus Group was asked to provide a range of fish consumption rates that the group deems to be credible and representative of various Oregon fish-consuming populations. The Oregon Environmental Quality Commission, ODEQ's governing body, is responsible for choosing a fish consumption rate(s), or alternatively, a range of consumption rates. This risk management decision will specifically consider the people that will be protected by the human health-based water quality criteria (e.g. the general population, tribal populations, children and other sensitive populations), and what percentage of those populations to protect. The Environmental Quality Commission will be responsible for considering whether to include Pacific salmon in the rate, if there should be a single statewide fish consumption rate or various rates for different regions, and how revised human health criteria will be implemented. Overall, the Fish Consumption Rate Project encompasses a complicated mix of science and policy considerations.

The discussion and conclusions presented in this report were generated in one year (May 2007 – May 2008), a relatively short time considering the scope of the questions addressed. This report should be used in conjunction with the wide range of literature on fish consumption data that already exists. Some of this literature can be found in the report's cited references (Chapter VIII), and in the attached bibliography of related literature sources (Chapter IX). This report is not a comprehensive review of all fish consumption surveys. It is a focused review of the fish consumption surveys most relevant to fish consumers in Oregon, a review which was subject to the time constraints of the overall Fish Consumption Rate Project schedule. EPA ambient water quality criteria guidance (USEPA 2000a) recommends that "states use regional or local consumption studies and consumption rates to adequately protect the most highly exposed population when developing state water quality criteria". Other relevant national and world studies on fish consumption patterns were also reviewed by the Human Health Focus Group members during this process, but time constraints prevented in-depth analysis of all of these studies. Additionally, this report represents a brief review and recommendations for how Pacific salmon should be considered in selecting a fish consumption rate, but does not provide a comprehensive review of the life histories or potential sources of contamination for Pacific salmon.

This report is a summary of the Human Health Focus Group discussions, recommendations, and conclusions for each of the three questions posed by ODEQ, EPA, and CTUIR. There are seven chapters in this report. The historical and regulatory background regarding selection of a fish consumption rate(s) for human health-based water quality criteria in Oregon are described in Chapter 2. The results and discussion of the Human Health Focus Group's review of fish consumption surveys relevant to Oregon are presented in Chapter 3. The Human Health Focus Group's discussion of the inclusion of Pacific salmon in the fish consumption rate is given in Chapter 4. The rationale and recommendations of the Human Health Focus Group for fish consumption rate(s) for Oregon are described in Chapter 5. A brief description of human health risk assessment and its application to human health-based water quality criteria is presented in Chapter 6. Finally, the conclusions and recommendations of the Human Health Focus Group for the Fish Consumption Rate Project are presented in Chapter 7.

Detailed Human Health Focus Group meeting minutes and information on the Human Health Focus Group meeting schedule can be obtained from ODEQ or online at (http://www.deq.state.or.us/wq/standards/fishfocus.htm)

2. BACKGROUND

Water quality standards are the foundation of ODEQ's water quality program and influence a variety of other programs within ODEQ. Standards are established to protect the designated uses of Oregon waters, such as fishing, swimming, irrigation, drinking water, and industrial use. Water quality standards consist of three basic elements: 1) designated uses; 2) numeric and narrative water quality criteria; and 3) an anti-degradation policy. In order to restore and maintain the chemical, physical and biological integrity of Oregon waters, ODEQ works with a wide range of public and private entities to administer the regulatory programs of the Clean Water Act (CWA) that are based on water quality standards.

Water quality criteria can be both numeric and narrative and are derived for the protection of aquatic life and human health. Both aquatic life and human health criteria are used to assess water quality monitoring data and identify impaired waters, establish waste load allocations for Total Maximum Daily Loads (TMDLs), evaluate projects seeking a CWA Section 401 water quality certification, control non-point source pollution, establish cleanup targets at hazardous waste sites, and establish permit limits through the National Pollution Discharge Elimination System water quality permits. Any change in water quality criteria would affect all ODEQ programs using those criteria.

The Fish Consumption Rate Project is focused on reviewing and revising the fish consumption rate, which is one variable used to calculate human health-based water quality criteria. These criteria are intended to protect the quality of state waters so that fish and shellfish can be consumed by all Oregonians without unacceptable risk to human health. All of Oregon's waters (except the Bull Run River[1]) are designated for fishing, which makes the importance of protecting those waters relevant to all Oregonians.

Oregon's water quality standards (beneficial uses and criteria) are adopted by the Oregon Environmental Quality Commission through an administrative rule development process. The Fish Consumption Rate Project will provide fish consumption rates that will be used to establish water quality criteria for protection of human health. The application of human health-based water quality criteria in the CWA regulatory programs mentioned previously occurs in all waters of the state. According to Oregon Administrative Rule (OAR) 340-041-0001, *"Waters of the State" means lakes, bays, ponds, impounding reservoirs, springs, wells, rivers, streams, creeks, estuaries, marshes, inlets, canals, the Pacific Ocean within the territorial limits of the State of Oregon, and all other bodies of surface or underground waters, natural or artificial, inland or coastal, fresh or salt, public or private (except those private waters that do not combine or effect a junction with natural surface or underground waters) that are located wholly or partially within or bordering the state or within its jurisdiction.*

EPA's nationally recommended fish consumption rates are based on data from United States Department of Agriculture's (USDA) 1994-1996, 1998 Continuing Survey of Food Intake by Individuals (CSFII) and reported in USEPA 2002b.

Implementing and enforcing human health-based water quality criteria in waters of the state will only have an effect on those fish and shellfish species residing in and exposed to those waters. Thus, the selection of a fish consumption rate to be used in Oregon human health-based water quality criteria may only include those fish and shellfish species directly influenced by waters of the state. The territorial limits of Oregon extend three nautical miles from shore into the Pacific Ocean.

Oregon's current numeric human health criteria are based on EPA's 2002 recommended CWA Section 304(a) water quality criteria (USEPA 2002a). EPA derived these criteria by considering

[1] The Bull Run River is located inside a watershed that is closed to public access and is therefore not accessible for fishing.

the known toxicity of the regulated chemicals and the likely exposure people have to these chemicals. These criteria are based on a specific set of variables for estimating exposure including fish consumption rate and human body weight. EPA's current recommended CWA Section 304(a) human health-based water quality criteria are calculated using the national fish consumption rate of 17.5 g/day (USEPA 2000a). This nationally recommended rate is roughly equivalent to two, eight-ounce fish meals per month. This rate represents the 90th percentile of all people (fish consumers and non-consumers) who were interviewed from across United States.

ODEQ is considering which fish consumption rates are most appropriate to use in calculating water quality criteria that are protective of human health. These criteria will apply to Oregon waters and will be implemented through CWA regulatory programs such as National Pollution Discharge Elimination System water quality permits, water quality assessments, and Total Maximum Daily Loads. ODEQ is considering raising the fish consumption rate in part because a local study shows that the Columbia River Tribes (CRITFC 1994) eat substantially more fish than the current EPA default rate of 17.5 g/day (USEPA 2000a). EPA, in an August 15, 2005 letter to the Environmental Quality Commission (ODEQ's rulemaking body), suggested that, "Current information indicates that a fish consumption rate in the range of 105 to 113 g/day may be appropriate for some waters in Oregon, Washington, and Idaho including a number of reaches of the Columbia River (based on studies prepared by EPA and the Columbia River Inter-Tribal Fish Commission)" (Kreizenbeck 2005). Other studies identified in this report demonstrate the existence of other high-volume fish consumers in Oregon, in the United States generally and in the world. An increase in the fish consumption rate in Oregon would result in more stringent human health-based water quality criteria.

Until 2003, Oregon's water quality standards were based on a fish consumption rate of 6.5 g/day, consistent with EPA's default fish consumption rate (USEPA 2000a). EPA increased its recommended rates to a nationally-based per capita default level of 17.5 g/day while urging states to rely on local consumption data wherever possible (USEPA 2000a).

From 1999 to 2003, two separate teams reviewed the water quality standards and considered potential revisions: the ODEQ's Technical Advisory Committee (TAC) and the Policy Advisory Committee (PAC). When reviewing the appropriate fish consumption rates to calculate the human health-based criteria, the TAC proposed a tiered approach for the Oregon criteria:

1) EPA's (USEPA 2000a) default fish consumption rate (17.5 g/day) for low intensity fish consumption,
2) EPA's (USEPA 2000a) recommended subsistence fish consumption rate (142.4 g/day), for medium intensity fish consumption
3) The ninety-ninth percentile of the Columbia River Basin Tribal fish consumption rates (389 g/day, from CRITFC 1994) for high intensity fish consumption.

The PAC, upon reviewing the TAC's recommendations, had concerns about how this tiered system would be implemented, and could not come to consensus on what the appropriate fish consumption rate should be for calculating the human health-based water quality criteria.

Subsequently, ODEQ recommended to the Environmental Quality Commission that it adopt EPA's 2002 recommended CWA Section 304(a) water quality criteria for toxic pollutants, including the human health criteria (USEPA 2002a), with a few exceptions. The Environmental Quality Commission adopted these criteria, and the revised water quality criteria were submitted to the EPA on July 8, 2004 for its review and approval.

The CWA directs EPA to review and either approve or disapprove water quality standards submitted by states and authorized tribes (40CFR Part 131.5). EPA has not yet taken any action on Oregon's revised human health-based water quality criteria that were submitted on July 8, 2004, but has recommended that Oregon consider adopting a rate of 105-113 g/day for some waters in Oregon in order to be more protective of people who eat fish (Kreizenbeck 2005).

3. EVALUATION OF FISH CONSUMPTION SURVEYS

3.1 FISH CONSUMPTION SURVEYS REVIEWED

The purpose of the Human Health Focus Group review of fish consumption surveys was to establish a body of literature that documents the range of fish consumption rates practiced by fish consuming groups in the Pacific Northwest; and from which Oregon can choose a fish consumption rate.

With the help of ODEQ and EPA, the Human Health Focus Group compiled a list of national and international surveys for review. National and international studies (Table 1, located at the end of this document) demonstrate that there are a wide range of populations with diverse cultures, traditions, and practices that result in a very broad range of fish consumption patterns. This variability can be expected in any population of statewide scale and in some cases, similar variability can be seen in much smaller populations.

3.1.1 SELECTION OF RELEVANT FISH CONSUMPTION SURVEYS

Current EPA (USEPA 2000a) ambient water quality criteria guidance for adopting state fish consumption rates recommends the use of local and regional fish consumption data first, the use of national studies second, and recommends reliance on EPA default rates only if no specific regional data are available.

The Human Health Focus Group established an informal set of procedures for determining which surveys were the most relevant for Oregon and the most useful for estimating fish consumption rates. These procedures included but were not limited to the following considerations:

1) Survey design,
2) Survey questionnaire,
3) Population surveyed,
4) Statistical analysis, and
5) Type of fish and shellfish consumed

Of the national and international studies listed in Table 1, eight regional surveys and one national fish consumption survey reviewed by the Human Health Focus Group were found to be relevant for developing fish consumption rate(s) for Oregon Water Quality Criteria. With this guidance

and Oregon's population in mind, nine fish consumption surveys (Table 1) were chosen for detailed review. A survey was determined relevant if the people surveyed were from Oregon or their fish consumption patterns are what one might expect from the people of Oregon.

The nine relevant surveys are:

- A Fish Consumption Survey of the Umatilla, Nez Perce, Yakama, and Warm Springs Tribes of the Columbia River Basin (CRITFC 1994)
- Fish Consumption, Nutrition, and Potential Exposure to Contaminants Among Columbia River Basin Tribes. – A Masters thesis by Neil A. Sun Rhodes, Oregon Heath Sciences University (Rhodes 2006)
- Columbia Slough and Sauvie Island Fish Consumption Survey, Technical Memorandum on the Results of the 1995 Fish Consumption and Recreational Use Surveys, Amendment No. 1 (Adolfson Associates 1996)
- A Fish Consumption Survey of the Tulalip and Squaxin Island Tribes of the Puget Sound Region (Toy *et al.* 1996)
- Fish Consumption Survey of the Suquamish Indian Tribe of the Port Madison Indian Reservation, Puget Sound Region (Suquamish 2000)
- Asian and Pacific Islander Seafood Consumption Study (Sechena *et al.* 1999)
- Lake Whatcom Residential and Angler Fish Consumption Survey (WDOH 2001)
- Consumption Patterns of Anglers Who Frequently Fish Lake Roosevelt (WDOH 1997)
- Estimated Per Capita Fish Consumption in the United States (USEPA 2002b)

3.1.2 Selection of Surveys Most Useful for Recommending Fish Consumption Rates

In this review, a survey was determined useful if the quantitative results can be relied upon as good estimates of fish consumption rates for the population surveyed. Of the nine fish consumption surveys considered to be relevant by the Human Health Focus Group, the following five surveys were determined to have the most useful data for estimating quantitative fish consumption rates:

- A Fish Consumption Survey of the Umatilla, Nez Perce, Yakama, and Warm Springs Tribes of the Columbia River Basin (CRITFC 1994)
- A Fish Consumption Survey of the Tulalip and Squaxin Island Tribes of the Puget Sound Region (Toy *et al.* 1996)
- Fish Consumption Survey of the Suquamish Indian Tribe of the Port Madison Indian Reservation, Puget Sound Region (Suquamish 2000)
- Asian and Pacific Islander Seafood Consumption Study (Sechena *et al.* 1999)
- Estimated Per Capita Fish Consumption in the United States (USEPA 2002b)

Four of the original nine studies were eliminated for further consideration for various reasons. The Lake Whatcom, Lake Roosevelt, Sauvie Island and the Columbia Slough are good studies, but the reported values in each of these studies were not adequate for calculating accurate fish consumption rates. The re-evaluation of the Umatilla, Nez Perce, Yakama, and Warm Springs Tribal (CRITFC 1994) data by Rhodes did not provide any new quantitative data that would change the results of the original survey of the Columbia River Basin Tribes (CRITFC 1994).

3.1.3 Results of Review of Nine Surveys

The result of the Human Health Focus Group's evaluation of the nine surveys is provided in the following section.

A Fish Consumption Survey of the Umatilla, Nez Perce, Yakama, and Warm Springs Tribes of the Columbia River Basin (CRITFC 1994)

Relevance

The survey of Columbia River Basin Tribes (CRITFC 1994) is regarded as the study most relevant to Oregon fish consumers. The Confederated Tribes of the Umatilla Indian Reservation and the Warm Springs Tribe, two of the four tribes surveyed, are both located in Oregon, which makes the survey a direct measure of an Oregon population. The Yakama Tribe (Washington) and Nez Perce Tribe (Idaho) both fish in parts of the Columbia River Basin in Oregon

The survey reported that 97 percent of the people interviewed eat fish. Other surveys reviewed by the Human Health Focus Group demonstrated that Asian and Pacific Islanders and Eastern European communities also consume fish at levels similar to Oregon Tribes.

The fish species consumed by Columbia Basin Tribes (CRITFC 1994), either spend their entire life in Oregon waters or part of their life in Oregon waters (Appendix A-1). The fish reported as consumed in this survey include trout, northern pike-minnow, sturgeon, suckers, walleye, and whitefish. The study also reported consumption of Pacific salmon, steelhead, lamprey, shad, smelt, and sturgeon. This is significant because all of these fish are affected by the quality of Oregon waters for all or part of their life cycle. Furthermore, 88 percent of the fish consumed by the Columbia Basin River Tribes originated from the Columbia River Basin (CRITFC 1994).

No consumption of any shellfish or open ocean finfish species was reported. The questionnaire used in the interviews did not include specific questions about marine species or shellfish. Since these questions were not asked in the interview, it is not clear how this may have affected the fish consumption rates reported by the Columbia River Tribes. Since the people of Oregon are likely to eat coastal marine seafood, the Columbia River Tribal data may not be relevant with respect to the marine and shellfish consumption patterns of Oregonians.

In summary, with the exception of the marine fish and shellfish component, the survey of Columbia River Basin Tribes (CRITFC 1994) is relevant to Oregon fish consumers because it offers a reliable and direct measurement of fish consumption by an Oregon population.

Utility

The fish consumption data reported in this survey are useful for the purposes of establishing water quality criteria for Oregon. This study was peer-reviewed and represented a random selection of 513 adult survey participants ages 18 and older from four Columbia River Basin Tribes (CRITFC 1994). Survey participants also provided information for 204 children ages five and younger from adult participant's households. The adult participants were interviewed by trained tribal representatives and asked to report 24-hour recall, weekly, monthly, seasonal, and 20-year average fish intake. The weekly estimates of fish consumption and data on serving size

were used to determine the grams per day of fish consumed by each respondent. The survey's overall average and distributed rate of consumption were calculated from the individual rates. The survey did not include body weights for individual participants. This did not affect the overall usefulness of these data, since most consumption patterns are based on a measurement of grams per person per day. However, the accuracy of this measurement for individuals is reduced.

Although the raw data were not available for re-analysis, there was good documentation of the summary statistics conducted. The highest fish consumption rates were not categorized using any statistical methods, but rather considered "unreasonably high" and not included in the statistical analysis.

FISH CONSUMPTION, NUTRITION, AND POTENTIAL EXPOSURE TO CONTAMINANTS AMONG COLUMBIA RIVER BASIN TRIBES (RHODES 2006)

Relevance

This study is a re-evaluation of the original survey of the Columbia River Basin Tribes by CRITFC (1994). Thus it is relevant for developing a fish consumption rate for Oregon. There are no changes (no corrections) in the rate of consumption for the Columbia River Basin Tribes.

Utility

This report provides additional multivariate analysis on the correlation between fish consumption rates and factors including breast feeding after most recent births, percent of fish obtained non-commercially for women who recently gave birth, living off the reservation, and fish consumption rates for children and the elderly. This re-evaluation resulted in no changes or corrections to the consumption rates presented in the original Columbia River Basin Tribal survey (CRITFC 1994). Therefore, the data reported in this survey, were not included in the Human Health Focus Group's deliberations.

COLUMBIA SLOUGH AND SAUVIE ISLAND FISH CONSUMPTION SURVEY, TECHNICAL MEMORANDUM ON THE RESULTS OF THE 1995 FISH CONSUMPTION AND RECREATIONAL USE SURVEYS, AMENDMENT NO. 1 (ADOLFSON ASSOCIATES 1996)

Relevance

This study is regarded as being relevant to fish consumers in Oregon as it provides a description of the race, ethnicity, age and gender of the people fishing and the types of fish species caught and consumed in the Portland, Oregon metropolitan area. The study also provides information on various methods of fish preparation by local populations, other fishing frequencies and local fishing locations.

Utility

The data reported in this creel survey are not useful for quantitative assessment of fish consumption rates but provide regional information of subsistence fishers in the Portland metropolitan area. This study was conducted primarily on land and one day on water for 20 randomly selected days over a one month period. Both the days and times selected to conduct the survey utilized a stratified random sampling methodology. The survey team was trained and

multi-lingual. A total of 91 interviews were conducted in the Columbia Slough and 55 interviews on Sauvie Island. The species, weight and length of the fish caught on the day of the interview was reported in addition the number of people consuming the catch. This survey has significant limitations for calculating individual fish consumption rates.

The quantitative fish consumption rates were limited by the inconsistencies in how individuals reported their fish consumption. The survey interviewers noted that individuals had difficulties in reporting the quantity of fish they consumed. Additionally, only fish weighed by the surveyors were counted in consumption estimates and of those fish, only 30 percent of the total weight of fish was regarded as edible despite the preparation method reported by the individual. Finally, if the participant reported that other people in the household ate fish, the individual consumption was simply divided by the number of people and individual portion size was disregarded. Overall, there was not sufficient information to calculate reliable fish consumption estimates.

A FISH CONSUMPTION SURVEY OF THE TULALIP AND SQUAXIN ISLAND TRIBES OF THE PUGET SOUND REGION (TOY ET AL. 1996)

Relevance

The Tulalip and Squaxin Island Tribes survey is regarded as being relevant to Oregon fish-consuming populations; although some of the fish and shellfish they consumed may not be found in Oregon waters (Appendix A-2). Oregon does not have a marine body of water comparable to the size and complexity of Puget Sound, which is the fishing ground for the Tulalip and Squaxin Island Tribes. Places in Oregon such as Coos, Tillamook, and Nehalem Bays may provide a proportionally smaller habitat for comparable finfish and shellfish species that are found in Puget Sound. The life histories or habitat classifications of finfish or shellfish species were not included in the report, although they did identify those species that are found in Puget Sound.

Toy *et al.* (1996) states, "if the fish consumption rates in this report are to be used to represent fish consumption in other tribal populations, information should be collected about their species consumption, preparation methods and other relevant factors". The origin of fish consumed in the Tulalip and Squaxin Island Tribes survey was divided into five categories: a) those caught in Puget Sound, b) those caught outside Puget Sound, c) those eaten in restaurants, d) those purchased from grocery stores, and e) other. Anadromous fish (e.g. Pacific salmon) were the most heavily consumed fish group, of which 72-80 percent was caught in Puget Sound. Seventy-five percent of the shellfish consumed came from Puget Sound. Less than 50 percent of the open ocean fish (e.g. cod, Pollock) consumed by The Tulalip and Squaxin Island Tribes were collected from the Puget Sound.

The rates in this report are specifically relevant to Oregon fish-consuming populations, especially the coastal communities. Since the results are comparable to the fish consumption rates of members of the Columbia River Basin Tribes (CRITFC 1994), it demonstrates a simple relationship between tribal fish-consuming populations in the Pacific Northwest: people eat what's available to them and what's culturally preferred. Additionally, there are patterns of high consumption rates in Pacific Northwest Tribes regardless of species consumed or origin of the fish.

Utility

The fish consumption data reported in this survey are useful for the purposes of establishing water quality criteria for Oregon. This study represented a random selection of 190 adult survey participants from the Tulalip and Squaxin Island Tribes in Washington State. Additionally, survey participants provided information on 69 children of age six years and younger. The participants were interviewed by trained tribal representatives and asked to report on the number of fish meals eaten per day, per week, per month or per year over a one-year period and the portion size of each meal. Individual consumption rates were calculated using the portion size reported and the frequency of consumption, which depended upon how the participant reported it (daily, weekly, monthly, yearly). Any participant that did not eat any fish at all (non-consumer) was not included in the survey or data analysis since the survey objective was to ascertain the consumption rates of people who did eat fish.

The participants also reported their own body weight, which allowed for the calculation of consumption rates in grams per kilogram per day (g/kg/day). Including human body weights enhances the accuracy of estimating risk to any given individual. This study presented varied and useful analyses and summary statistics. There were a number of large consumption rates reported for this study. These high rates were considered outliers (an observation that is numerically distant from the rest of the data). The outliers were re-coded "…to the largest reported consumption rate within three standard deviations of the arithmetic mean" (Toy *et al.* 1996). Toy *et al.* 1996 acknowledged that, when calculating central tendencies, there is the potential that excluding outliers in such a manner may add bias in studies specially designed to examine variation and range of fish consumption and such biases would underestimate true fish consumption.

FISH CONSUMPTION SURVEY OF THE SUQUAMISH INDIAN TRIBE OF THE PORT MADISON INDIAN RESERVATION, PUGET SOUND REGION (SUQUAMISH 2000)

Relevance

The Suquamish Tribe survey is regarded as being relevant to Oregon fish-consuming populations. The type of fish caught in Puget Sound varies from those found in Oregon waters (Appendix A-3). While there is not a one hundred percent correlation between Puget Sound and Oregon waters this limitation does not affect the relevance of this study to Oregon populations.

The origin of fish consumed was divided into five categories: a) those caught in Puget Sound, b) those caught outside Puget Sound, c) those eaten in restaurants, d) those purchased from grocery stores, and e) other. The most heavily consumed fish groups in this survey were Pacific salmon (including steelhead) and shellfish. For both of these groups, 80-90 percent of the fish or shellfish consumed was harvested, of which the vast majority was harvested in Puget Sound. All other fish groups exhibited much lower harvest rates (less than 50 percent) and had higher percentages of restaurant or grocery origin. These data show that for certain groups of fish (Pacific salmon and shellfish) the local (Puget Sound) harvest comprises the vast majority of fish consumed.

This study of the Suquamish Tribe follows the same methodology within the same basin (Puget Sound) as the study of the Tulalip and Squaxin Island Tribes. Thus, the rates in this report are specifically relevant to Oregon fish-consuming populations, especially the coastal communities.

Utility

The fish consumption data reported in this survey are useful for the purposes of establishing water quality criteria for Oregon. This study represents a random selection of 92 adult survey participants from the Suquamish Tribe. Additionally, survey participants provided information on 31 children ages six years and younger. The participants were interviewed by trained tribal representatives and asked to report on the number of fish meals eaten per day, per week, per month or per year over a one-year period and the portion size of each meal. Individual consumption rates were calculated using the portion size reported and the frequency of consumption, which depended on how the participant reported it (daily, weekly, monthly, yearly). All 92 survey respondents reported eating some type of fish which meant there were no "non-consumers" among the respondents. The participants also reported respondent body weight, which allowed for the calculation of consumption rates in g/kg/day. Including body weight enhances the accuracy of estimating risk to any given individual or population. Good summary statistics were presented in the report with useful and varied analyses of the data. The analysis did not exclude any data.

The Suquamish staff chose to include high consumption rates because they were familiar with the individuals eating those large quantities and that the consumption rates reported were likely to reflect real consumption (Suquamish 2000). With no adjustments made for the high consumption rates, it was noted that the reported means may be highly influenced by the consumption of just a few individuals.

ASIAN AND PACIFIC ISLANDER SEAFOOD CONSUMPTION STUDY (SECHENA ET AL. 1999)

Relevance

The Asian and Pacific Islander survey is regarded as being relevant to Oregon fish-consuming populations (with some limitations), as there were a significant number of marine finfish and shellfish species consumed by people interviewed in this study that may or may not be found in certain Oregon waters (see Appendix A-4).

The origin of fish consumed was divided into four categories: a) those harvested in King County, b) those caught outside King County, c) those eaten in restaurants, and d) those purchased from grocery stores or street vendors. The most heavily consumed fish group in this survey was shellfish. For all fish groups, 79-97 percent of the seafood consumed came from either groceries/street vendors or restaurants. Seafood known to be harvested locally comprised from three percent to twenty-one percent of their diet. These data show that the vast majority of fish and shellfish consumed by Asian and Pacific Islanders is obtained through groceries/street vendors and restaurants.

The rates in this report are potentially relevant to Oregon fish-consuming populations such as the Asian and Pacific Islander communities in Oregon. The vast majority of seafood consumed was purchased, but it is not known what proportion of purchased fish was locally caught. Despite

this limitation, the study is still relevant to the Asian and Pacific Islanders of Oregon as an indicator of their fish consumption patterns.

Utility

The data on fish consumption rates reported in this survey are useful for the purposes of establishing water quality criteria for Oregon. This study represented a selection of 202 adult survey participants from 10 different ethnic communities that comprise the Asian and Pacific Islander community of King County, Washington. The participants were interviewed by trained representatives from each of the ethnic communities represented and asked to report on the number of annual servings and the portion size of the servings. Individual consumption rates were calculated using the portion size reported multiplied by the number of annual servings and then divided by 365 days times the respondent's body weight. Any participant that did not eat any fish was not included in the survey or data analysis since the survey objective was to ascertain the consumption rates of people who did eat fish.

The participants also reported their own body weights, which allowed for the calculation of consumption rates in g/kg/day. Including human body weights enhances the accuracy of estimating risk to any given individual or population.

Summary statistics were presented in the report with useful and varied analyses of the data. The authors (Sechena *et al.* 1999) reported that there were an usually large number of high fish consumption rates. The values that were identified as outliers were those observed values greater than three standard deviations above the mean. These outliers were then given a smaller value equal to the mean plus three standard deviations.

CONSUMPTION PATTERNS OF ANGLERS WHO FREQUENTLY FISH LAKE ROOSEVELT (WDOH 1997)

Relevance

This survey is regarded as being relevant to Oregon fish consumers. The populations surveyed in this study are likely to exist on a comparable lake in Oregon. The species reported in the survey included kokanee, rainbow trout, walleye and bass. Some or all of these species are likely to be found in Oregon lakes as well. Survey participates were primarily vacationing boat anglers returning from fishing trips. No tribal members were surveyed.

Utility

The data reported in this survey are not useful for quantitative assessment of fish consumption rates. This survey was conducted to determine the consumption patterns of anglers who repeatedly fish in Lake Roosevelt. Creel and fish consumption surveys were conducted at boat launches with people returning from their fishing trips at randomly selected locations. The survey was pilot tested and administered by creel clerks over a four to five month period during 1994 and 1995. The survey protocol was slightly altered from one year to the next to collect more accurate and meaningful consumption data. A total of 448 interviews were conducted. Anglers who did not consume fish (total of 57) were not included in the data analysis. Data collected showed that 84 percent of all respondents were members of two adult households.

The fish consumption rates derived from this survey were not useful because of inconsistencies in how the consumption information was reported. Although the frequency of consumption was obtained, there were difficulties in obtaining the portion size consumed at each meal, which led to further difficulties in calculating individual consumption rates. Therefore, actual consumption rates were not reported, but frequency of consumption and number of fillets eaten per meal was reported.

LAKE WHATCOM RESIDENTIAL AND ANGLER FISH CONSUMPTION SURVEY (WDOH 2001)

Relevance

This survey is regarded as being relevant to Oregon fish consumers as populations similar to those surveyed in this study are likely to exist on a comparable lake in Oregon. The species reported in the survey included smallmouth bass, yellow perch, kokanee, cutthroat trout, and signal crayfish. Some or all of these species are likely to be found in Oregon lakes as well. The source of the fish consumed was Lake Whatcom. There was no indication through the survey protocol if those interviewed consumed harvested fish from any other lake, river, or bay. There was, however, a question about the consumption of canned tuna fish since the study was driven originally by concerns of mercury exposure. Nineteen of the 242 respondents consumed tuna an average of 4.2 times over the previous four weeks. This fact may indicate that these respondents are frequent "fish eaters" and may supplement their diets with fish from other sources such as restaurants or grocers stores.

Utility

This study was designed to collect fish consumption information from residents who live on or near the lake or in developments with direct access to the lake, boat anglers accessing the lake at public boat launch facilities, and shore anglers. Although, the data reported in this survey are not useful for quantitative assessment of fish consumption rates, the study provides some information on types of fish collected and eaten, even in the presence of fish advisories. Only average meal sizes were calculated, and an accurate frequency of meals per week or month was not clearly presented. Due to elevated mercury levels in some fish species reported in a screening survey from Lake Whatcom, Washington, fishing was already influenced by perceived contamination as reported in local media. This study also gathered information regarding the respondents' perceptions and likely reactions to a fish consumption advisory. There were trained interviewers who went door-to-door in the randomly selected residencies and approached anglers during specified times on the boat launches and the shore. There interviewees included residents (194), boat anglers (38), and shore anglers (10).

The participants were asked to report on how many times over the previous four weeks they had eaten fish from Lake Whatcom, how many fish were eaten per meal, and how many months per year they consumed Lake Whatcom fish. They were also asked to report typical meal size based on a picture of a Pacific salmon fillet. Fish consumption rates were calculated using the number of reported fish eaten per meal multiplied by the average fillet weight of that species, which was obtained from a previous Lake Whatcom fish sampling effort.

The fish consumption rates from this survey were not useful because of inconsistencies on how the interviewees reported their fish consumption. The four-week recall diet limited the ability to

fully quantify fish consumption due to the low number of people that consumed fish during that period. Although some limitations exist for the data, they do provide an indication of the amount of fish consumed exclusively from Lake Whatcom, Washington following the media coverage of potential contamination issues.

ESTIMATED PER CAPITA FISH CONSUMPTION IN THE UNITED STATES (USEPA 2002B

Relevance

This large national study is relevant to Oregon and provides context upon which specific, regional data can be based. The methodology used to conduct the survey and analyze the data is useful for analyzing fish consumption trends of the U.S. population via per-capita consumption rates. The study does not report state-specific fish consumer survey results from Oregon alone but was designed as a national study.

There was a wide variety of fish consumed in this survey, some of which may be found in Oregon waters.

Utility

The EPA national estimates of fish consumption (USEPA 2002b) are considered useful for the purposes of establishing water quality criteria for Oregon. The EPA national estimates (USEPA 2002b) were based on combined data from the USDA 1994-1996 and 1998 Continuing Survey of Food Intakes by Individuals (CSFII). The survey of 20,607 people (adults and children) was well designed to be statistically representative of the overall per-capita consumption rates of the U.S. population. The 24-hour dietary recall was administered by an interviewer and was conducted on two non-consecutive days. Data collection from these surveys spanned a period of four years. For this national survey individuals were interviewed in-person on their food intake on two non-consecutive days. Advantages of the survey methodology are that is that it is statistically representative of all 50 states, it has a good design for per-capita consumption estimates, the interviewer administration enhances its accuracy, and it was administered on non-consecutive days, which avoids correlated consumption data.

Because of the extraordinarily large survey population and the fact that individuals were chosen to statistically represent overall US populations this data set provides a valuable context for Pacific Northwest surveys.

Short-term data collection (two day - 24 hour recall) may not be representative of long-term consumption rates that have been averaged over time. However, since large numbers (20,607) of individuals were included in the EPA estimated per capita survey (USEPA 2002b and the survey includes more than one time period and season, there is a greater likelihood of capturing the distribution of consumption rates when compared to smaller surveys.

Since the goal of the USDA CSFII surveys was to represent the diet of all people (per capita) in the United States, the data included people who eat fish (consumers) and those who don't eat fish (non-consumers). Including non-consumer data in a fish consumption rate can result in misleadingly low fish consumption rates. In addition to reporting the per capita fish

consumption rates, EPA (2002) considered it appropriate to report the data for consumers only as well as the combined consumer and non-consumer data.

The Human Health Focus Group agreed that exposure assessments and the evaluation of potential risks to fish consumers must consider the consumption rates appropriate for actual consumers. Thus, EPA (USEPA 2002b) "consumer-only" data were examined for their usefulness. The statistical certainty of the USDA CSII Study was quite high because of the large number of participants (20,607). This certainty is reduced when "consumer-only" data for only adults are extracted because of the decrease in the number of people from 20,607 to 2,585. However, the Human Health Focus Group considered these rates to be useful for Oregon with the acknowledgement of decrease in statistical certainty.

3.1.4 General Discussion of Fish Consumption Survey Methodologies

The survey methodologies in the studies reviewed by the Human Health Focus Group include interview questionnaire (CRITFC 1994, Toy *et al.* 1996, Suquamish 2000, Sechena *et al.* 1999, dietary recall (USEPA 2002b) and creel surveys (Adolfson 1996, WDOH 1997, WDOH 2001). Each of these methodologies has individual advantages and disadvantages.

Fish consumption surveys are designed to estimate the fish consumption patterns of a target population. A number of potential biases can influence survey results. Response rates, literacy, and language barriers may affect the quality of data collected in surveys. Other sources of bias in a survey include interviewer bias, differential effort by interviewers or respondents, cultural differences in interpretation, recall bias or memory problems, and over- or under-reporting (OEHHA 2001). Finally, different methods of data analysis can yield very different estimates of consumption from the same dataset.

The four personal interview surveys reviewed by the Human Health Focus Group utilized local interviewers to conduct the interviews for their own groups, to ensure that the people being interviewed felt comfortable answering the survey questions. This approach helps enhance the trust of the interviewee and the effectiveness of communication during the interview. Personal interviews are often pilot-tested to enhance the relevance of the questionnaire.

Personnel interview surveys may suffer from recall bias as individuals lose accuracy as time from an activity increases. This becomes a challenging issue when individuals are asked to recall consumption rates over prior twelve months. An individual may remember that they ate fish a certain number of times but they may not remember the exact amount in each instance.

The Human Health Focus Group reviewed three creel surveys for this report. Creel surveys are field interviews of anglers at the site they are fishing. Many creel surveys include inspection of the angler's catch, which can increase survey accuracy. Creel survey results are limited by the locations, seasons, dates, and times of the interview. Language and literacy may present difficulties during an interview (USEPA 1998). Since interviews are based upon when the interviewer chooses to visit the angling site, interviewees are not prepared for the interview and may be less likely to participate. The interviewee also may not trust the stranger conducting the interview.

The Human Health Focus Group reviewed only one dietary recall survey for this report. Short-term data collection (two day - 24 hour recall) is a well accepted methodology for dietary studies because individuals more accurately recall recent events, such as the food they consumed within the last day). Recall surveys that are administered by a trained interviewer allow for consistency between participants and reduce the errors in reporting that are possible in self reported surveys. Correlated consumption data can occur if a participant cooks and eats fish on one day and then eats that same fish as leftovers the next day. This can be avoided by conducting the survey on non-consecutive days.

Although estimates of consumption from dietary recalls may be reported as g/day, the values may not be representative of long-term consumption rates that have been averaged over time and presented as a daily rate. Other fish consumption study methodologies consider fish consumption over a much longer period of time and are therefore more likely to more closely represent the fish consumption patterns of the population studied.

3.2 CONSUMERS-ONLY DATA

Fish consumption surveys typically include people who eat fish and people who don't eat fish. People who don't eat fish are termed "non-consumers". Those that do eat fish are considered "consumers". The proportion of non-consumers included in the survey will vary depending on the population being interviewed. For instance, of the 500 respondents in *A Fish Consumption Survey of the Umatilla, Nez Perce, Yakama, and Warm Springs Tribes of the Columbia River Basin* (CRITFC 1994), 93 percent were fish consumers. It is common among the tribal populations reviewed in this report to have a high percentage of fish consumers in their population. In contrast, EPA (USEPA 2002b) evaluated national data from approximately 20,000 individuals (3 years and older). Approximately 28 percent were fish consumers.

In EPA's *Estimated Per Capita Fish Consumption in the United States* (USEPA 2002b), fish consumption data were collected using a non-consecutive two-day dietary recall. Anyone who didn't eat fish on either of the two recall days was considered a non-consumer. This methodology has the potential to underestimate the number of consumers in a population. Furthermore, anyone who did eat fish on either of the two days would be considered a consumer. The data for an individual consumer were then assumed to be that person's rate of consumption for every day of the year. In this case, a reported value for short-term consumption on two survey days was used to estimate long-term or "usual" intake of fish and shellfish.

Oregon's current fish consumption rate of 17.5 g/day was determined on a per-capita basis for the entire U.S. population (USEPA 2002b) including fish consumers and non-consumers. All non-consumers are recorded as having a consumption rate of zero g/day. When averaging in the zero consumption rates of the non-consumers with the actual rates of the consumers, the resulting rates represent the averages across an entire population, and do not represent the actual fish consumption rate for people who eat fish.

Oregon's human health-based water quality criteria are developed to specifically protect individuals who consume fish, which would make the consumer-only rates most representative

of a fish-consuming population. Oregon should base its regulatory consumption rate on data specifically derived from consumers of fish.

3.3 SUPPRESSED RATES

The Human Health Focus Group also discussed some of the factors that may contribute to the suppression of fish consumption rates. Current reported fish consumption rates may be depressed compared to historic rates due to several factors: 1) significant reductions in fish populations, 2) the belief that fish that reside in polluted waters will bio-concentrate pollutants, 3) contaminated fish, and 4) the intended impact of local fish advisories or the unintended consequences of national fish advisories of commercial fish species that are not applicable to local waters

The Human Health Focus Group also noted that three of the five studies presented in Table 3 (in Section 5.2) excluded or discounted high fish consumers by identifying statistical outliers. This would have the effect of underestimating the true range in fish consumption rates. If the rates are already suppressed the elimination of the highest values may be reporting an artificially low fish consumption rate.

3.4 FISH SPECIES CONSUMED

There are a variety of fish and shellfish species represented in the studies reviewed. Fish and shellfish species can be classified as marine, estuarine, or freshwater based upon the habitat in which they are born/hatched, reproduce, grow, and die. Some species of fish or shellfish can spend portions of their life in multiple aquatic environments. Pacific salmon hatch in freshwater, migrate to the ocean and then return to freshwater to spawn and die. Other migratory species commonly consumed in Oregon include sturgeon, lamprey, smelt, and shad. Note that the white sturgeon is landlocked because of dams on the Columbia River.

The seafood species consumed by recreational and subsistence fishers are dependent upon where these people live and fish. The availability of fish and shellfish is a major factor influencing the types of seafood consumed by populations who harvest for consumption purposes. For example, tribal members interviewed in the survey of Columbia River Basin Tribes (CRITFC 1994) reported eating resident trout, northern pike-minnow, sturgeon, suckers, walleye, and whitefish. They also consumed Pacific salmon, lamprey, shad, smelt, and sturgeon. They did not report eating any shellfish or open ocean finfish species. This may be influenced by the fact that the Columbia River Basin Tribes (CRITFC 1994) questionnaire did not include questions about consumption of specific marine fish or shellfish species.

In contrast, the Puget Sound Tribes (Tulalip and Squaxin Island) reported eating a variety of marine and migratory fish species (e.g. cod, sole, Pacific salmon) and shellfish (e.g. clams) (See Appendix A-2). All of these tribes were consuming fish and shellfish that were available to them in their given harvest locations. Although direct comparisons of the fish and shellfish species consumed between the Columbia River Tribes and the Puget Sound Tribes are difficult, an overall comparison of consumption patterns among tribal fishers is relevant.

The surveys reviewed by the Human Health Focus Group (Table 1, located at the end of this document) suggest that fish consumers generally eat a variety of species that are most readily

available geographically and seasonally. Additionally, the ranges of consumption rates among fish consumers tend to be comparable regardless of the species that are available at a given location. Thus, it is reasonable to assume that persons who eat fish will change or substitute species based on availability, cost and accessibility.

4. PACIFIC SALMON IN THE FISH CONSUMPTION RATE

EPA's national default fish consumption rates are derived for specific fish habitats (freshwater, estuarine, marine 65 FR 66469, 2000a). The choice of a fish consumption rate to use in calculating water quality criteria can be influenced by what types of fish and shellfish are included in the rate.

Human health water quality criteria are applied to "waters of the state" (as previously defined) and are used to maintain and improve water quality through numerous CWA regulatory programs administered by ODEQ. Implementing and enforcing human health criteria in waters of the state will only affect those fish and shellfish species residing in and exposed to those waters. Since water quality criteria are only protective of Oregon waters, it is important to understand which fish and shellfish species are found in Oregon waters. This is not a simple task since Oregon waters technically extend three nautical miles off the Oregon coast. There are a wide variety of fish and shellfish that live within that nautical boundary for all or part of their life cycle. Complicating matters even further is the presence of migratory fish (e.g., Pacific salmon), which spend part of their life cycle in the freshwaters of Oregon and part of their life cycle in deep ocean waters that are outside Oregon's jurisdiction.

4.1 EPA CLASSIFICATION OF PACIFIC SALMON

For some species their life history involves multiple habitats (e.g. anadromous). EPA designated their habitat as fresh water/estuarine and marine on a case-by-case basis (Table 2 excerpt from USEPA 2002b). EPA classified the habitat of salmon based on commercial-landings data provided by the National Marine Fisheries Service for the period of 1989-1991 (65 FR 66469, 2000b). All landings of Pacific salmon, including Chum, Coho, King, Pink, or Sockeye were assigned to marine habitat. All landlocked Great Lakes salmon and farmed salmon received the classification of freshwater.

Migratory
Fish that move between multiple habitats (freshwater, estuarine, and marine).
Anadromous
Migratory fish that spend most of their lives in the sea and migrate to fresh water to breed (Myers, 1949 as reported in Bond, 1979)

As the landings of Pacific salmon were reported from the marine environment, Pacific salmon were classified as marine (USEPA 2002b) and excluded from the national default fish consumption rates for calculating water quality standards. However, states and authorized tribes can make alternative assumptions to specifically account for the preferences of the specific population (Oregon) of concern.

TABLE 2 EPA HABITAT APPORTIONMENTS (EXCERPT FROM TABLE 2-1 HABITAT APPORTIONMENTS, EPA 2002B)

		USDA CSFII food survey database	
Species	**Habitat**	**1994-1996**	**1998**
Flatfish	Estuarine (Flounder)	90	84
	Marine (Halibut)	10	16
Clams	Estuarine (softshell)	2	3
	Marine (Ocean Quahog, Quahog, Atlantic Surf, and remaining hardshell species)	98	97
Crab	Estuarine (Blue, Soft, Hard, Peeler, Dungeness)	66	47
	Marine (King, Snow, Jonah, and Other	34	53
Scallop	Estuarine (Bay)	0.6	0.7
	Marine (Calico and Sea)	99	99
Salmon	Freshwater (Great Lakes)	0.06	0.05
	Estuarine (Aquaculture)	3	5
	Marine (Pacific)	97	95

4.2 PACIFIC SALMON IN OREGON WATERS

Pacific salmon and other migratory species present a rather complicated life history for establishing habitat preferences. Pacific salmon reside and pass through waters of the state. They are spawned and develop in waters of the state, and, after spending time in the ocean, return to Oregon freshwaters to spawn and die. Additionally, local data reviewed by the Human Health Focus Group (CRITFC 1994) indicate that Pacific salmon are caught in waters of the state in addition to the deep marine water landing data that EPA relied upon to classify Pacific salmon.

Different Pacific salmon species have different life histories, and therefore use fresh and estuarine waters for different lengths of time, and at different intensities. For example, fall Chinook may be more at risk for uptake of toxic contaminants because of their greater use of shallow-water habitats in the estuary, where toxic sediments are most likely to accumulate (Fresh 2005). Spring Chinook enter fresh waters early in the year and do not spawn until late fall or early winter. These varying life histories also affect the exposure patterns in the marine portion of the Pacific salmon life history, where some stocks may spend more time in coastal waters within the regulatory boundaries of Oregon's water quality standards.

The source of the pollutants found in Pacific salmon tissue is not well understood. The Human Health Focus Group did not conduct a comprehensive review of the life histories or potential sources of contamination for Pacific salmon. Johnson *et al.* (2007a, b) studied the tissue residue levels of chemicals in juvenile Chinook salmon in the Columbia River. They detected the following fish tissue chemical residues: PCBs, DDT, and, to a small extent, aromatic hydrocarbons, chlordanes, aldrin, dieldrin and mirex. These data demonstrate exposure to toxic chemicals occurs during the freshwater portion of the Pacific salmon life cycle.

4.3 RELATIVE SOURCE CONTRIBUTION

If Pacific salmon is not included in the fish consumption rate, utilizing the concept of Relative Source Contribution (RSC) is another way to account for some of the potential risk from consuming Pacific salmon in addition to all other marine fish and shellfish. The purpose of the RSC concept is to account for all other sources of exposure other than those associated with consumption of freshwater and estuarine finfish and shellfish, such as skin absorption, inhalation, drinking water, marine fish, other foods, and occupational exposures.

EPA applies the concept of RSC to chemicals with a reference dose to account for exposure through consumption of marine fish, Pacific salmon and other non-fish sources. The RSC value is not applied to carcinogens. EPA's ambient water quality criteria guidance (USEPA 2000a) states that the concept of the RSC does not apply to carcinogens because regulatory agencies are only responsible for assessing incremental risk from exposure to contaminants in fish tissue and water and no other exposures. In addition EPA states that:

> "...health-based criteria values for one medium [water] based on linear low-dose extrapolation [cancer] typically vary from values for other media in terms of the concentration value, and often the associated risk level. ...Therefore, the RSC concept could not ... apply unless all risk assessments for a particular carcinogen ... resulted in the same concentration value and same risk level; that is, an apportionment would need to be based on a single risk value and level." (USEPA 2000a)

The RSC value is applied to chemicals with a reference dose to ensure that exposure to these chemicals, when combined with all other sources will not exceed the reference dose (65 FR 66473, 2000). Details of how the RSC values are incorporated into the equation to calculate human health-based water quality criteria can be found in EPA's *Methodology for Deriving Ambient Water Quality Criteria for the Protection for Human Health* (USEPA 2000a).

The RSC value could be applied to the 47 chemicals with a references dose within the current list of priority pollutants. Oregon currently applies the RSC values developed by EPA to human health-based water quality criteria for the following pollutants (more details are available in Appendix B):

- Antimony
- Methylmercury
- Thallium
- Cyanide
- Chlorobenzene
- 1,1, Dichloroethylene
- Ethylbenzene
- Toluene
- 1,2 Trans Dichloroethylene
- 1,2 Dichlorobenzene
- 1,4 Dichlorobenzene
- Hexachlorocyclo-pentadiene
- 1,2,4 Trichlorobenzene
- Gamma-BHC
- Endrin

The concept of the RSC is not applied to the other 32 toxicity reference dose-based criteria. This does not necessarily mean that other reference dose-based criteria do not have other routes of

exposure. It simply means that there may not be enough data for EPA to establish RSC values for these other 32 chemicals.

At this time the only pollutant whose exposure pathway is known to be primarily from marine fish and Pacific salmon is methylmercury. The primary source of methylmercury is through consumption of marine fish. Oregon's current criterion for methylmercury incorporates an RSC value of 2.7×10^{-5} milligrams per kilogram (mg/kg) of body weight per day that accounts for the consumption of marine fish shellfish and salmon (Appendices B and C). All other water quality criteria for which RSC values have not been developed do not encompass protection of humans through exposure via consumption of marine fish or Pacific salmon.

EPA provides guidance for calculating RSC values outside of its own default values (Appendix D). This process requires robust datasets on sources of exposure for individual chemicals. Data on other sources of exposure do not exist for Oregon. It would be difficult for ODEQ to develop Oregon-specific RSC values without assistance from EPA.

If Oregon-specific RSC values cannot be derived, then states and tribes have the option to rely upon the EPA default RSC value of 20 percent. In this approach states and tribes could apply an RSC value of 20 percent to the remaining 32 chemicals that have a reference dose. Since there are no data to evaluate whether the 20 percent default option for the remaining criteria satisfactorily accounts for exposure through Pacific salmon consumption and all other non-fish exposures, the Human Health Focus Group cannot evaluate the use of the RSC concept on its technical merits. Therefore, the use of a default RSC value of 20 percent remains a policy decision.

Double Counting
To prevent double counting, exposures considered through the relative source contribution factor should not be included in the fish consumption rate.

4.4 INCLUDING PACIFIC SALMON IN THE FISH CONSUMPTION RATE

Since Pacific salmon are a known part of the diet for fish-consuming populations in Oregon, the human health-based water quality criteria should account for the potential risk incurred from consuming Pacific salmon. The surveys reviewed by the Human Health Focus Group not only reveal that Pacific salmon is being eaten, but also indicate with varying degrees of accuracy how much Pacific salmon is being consumed. Knowing the amount of consumed Pacific salmon allows for measurable and scientifically defensible inclusion of Pacific salmon in the fish consumption rate. Including Pacific salmon in the fish consumption rate can provide more scientific certainty that Pacific salmon consumption is being accurately accounted for when calculating risk-based water quality criteria.

The alternative to including Pacific salmon in the fish consumption rate is using the concept of the RSC to account for Pacific salmon exposure. The concept of the RSC falls short of full protection because of insufficient data to calculate accurate RSC values, and the RSC process does not account for carcinogenic risk. However, there are reliable data available from studies on the consumption of Pacific salmon. Therefore, it is more accurate to account for the total human health risk by including Pacific salmon directly in the fish consumption rate rather than trying to address it through an estimated RSC value.

4.5 INCLUDING MARINE FISH IN THE FISH CONSUMPTION RATE

During discussions about inclusion of Pacific salmon in the fish consumption rate, the Human Health Focus Group also discussed the possibility of including all marine fish in the fish consumption rate. If a deep ocean fish such as tuna is consumed by an Oregonian, there is a potential that the fish may contain contaminants that would add to the health risk of the consumer. So, regardless of the source of the fish, fish consumers face potential risks. Although this is true, Oregon's fish consumption rate and its associated human health-based water quality criteria can only be applied to waters within the regulatory jurisdiction of the State of Oregon (OAR 340-041-0001(1)). The jurisdiction in marine waters is confined to Oregon's waters of the state, which extend three nautical miles into the Pacific Ocean from the Oregon coast.

5. SELECTING FISH CONSUMPTION RATES

5.1 PROCESS FOR SELECTING FISH CONSUMPTION RATES

A variety of quantitative fish consumption estimates were selected from the five surveys considered relevant and useful by the Human Health Focus Group:

- A Fish Consumption Survey of the Umatilla, Nez Perce, Yakama, and Warm Springs Tribes of the Columbia River Basin (CRITFC 1994)
- A Fish Consumption Survey of the Tulalip and Squaxin Island Tribes of the Puget Sound Region (Toy *et al.* 1996)
- Fish Consumption Survey of the Suquamish Indian Tribe of the Port Madison Indian Reservation, Puget Sound Region (Suquamish 2000)
- Asian and Pacific Islander Seafood Consumption Study (Sechena *et al.* 1999)
- Estimated Per Capita Fish Consumption in the United States (USEPA 2002b).

The following process was used by the Human Health Focus Group to refine the recommended fish consumption rates:

1) Eliminate fish consumption rates that include non-fish-consuming populations
2) Include all fish consumption estimates regardless of the source of the fish (harvested or purchased)
3) Include fish consumption estimates for all types of seafood (fish and shellfish species) from marine, freshwater, and estuarine habitats.

1) Eliminate fish consumption rates that include people who don't eat fish.

Oregon's human health-based water quality criteria are developed to specifically protect individuals who eat fish. Therefore it seems most appropriate to select those fish consumption estimates for people who eat fish and exclude estimates that include people who don't eat fish. The inclusion of the non-fish consuming population lowers the consumption rate and thus reduces the level of protection for the people who do eat fish.

2) *Include all fish consumption estimates regardless of the source of the fish (harvested or purchased).*

In some surveys, the respondents report on the source of the fish they consume. Sources of fish and shellfish can include self-harvested, or purchased from stores or restaurants. The fish and

shellfish that are purchased may be locally caught. The Human Health Focus Group decided that it is more important to capture the fish consumption rate for all fish consumed rather than excluding those estimates for fish that was purchased.

3) *Include fish consumption estimates for all types of seafood (fish and shellfish species) from marine, freshwater, and estuarine habitats.*

Deep ocean fish that are found beyond three nautical miles off the Oregon coast (tuna, shark, halibut, etc) are not included in the current fish consumption rate in Oregon. ODEQ was not able to provide a list of the exact species that would be considered near-shore marine fish that live within three nautical miles of the coast. Therefore these particular species could not be isolated from the deep ocean fish in the surveys.

In addition to marine species, EPA's national guidance recommends that Pacific salmon and other migratory species be excluded from the fish consumption rates for water quality criteria.

Exposure to chemicals in marine fish and migratory fish including Pacific salmon is accounted for through the concept of the RSC. Thus, people who eat these fish may be protected through an indirect measure of exposure. However, there is only one chemical (methylmercury) where marine species (Pacific salmon and other migratory species), are accounted for using the concept of RSC. Due to EPA's policy regarding the lack of data that prevents the application of the concept of RSC across all other chemicals and endpoints such as carcinogenesis, the Human Health Focus Group chose not to recommend use of the RSC approach.

Oregonians eat a variety of fish species that may be harvested from fresh water, estuarine, or marine habitats. All types of fish and shellfish are included in the fish consumption rates recommended by the Human Health Focus Group. In particular, Pacific salmon is a major component of fish consumption in Oregon. Including Pacific salmon and other migratory species in the fish consumption rate can provide more scientific certainty that these species are accurately accounted for when calculating water quality criteria.

The alternative to including salmon in the fish consumption rate, as explained in the report, is using the concept of the RSC to account for salmon exposure. This will fall short of full protection because sufficient data are not available to calculate accurate RSC values, and the RSC process does not account for carcinogenic risk. Therefore, it is more accurate to account for the total human health risk by including salmon directly in the fish consumption rate itself.

5.2 RECOMMENDED FISH CONSUMPTION RATES

The final fish consumption rates identified by the Human Health Focus Group are presented in Table 3. The range of fish consumption rates presented in Table 3 provides a scientific basis for choosing a fish consumption rate and establishing water quality criteria that are protective of Oregonians that eat fish. A range of statistical values from each of the five studies: the mean, the median, and the 75th, 90th, 95th, and 99th percentiles are listed in Table 3. Note that there are six surveys reported in five studies. The Toy *et al.* report includes surveys of two tribes (Squaxin Island Tribe and Tulalip Tribes).

TABLE 3. ADULT FISH CONSUMPTION RATES (GRAMS PER DAY) RECOMMENDED BY THE HUMAN HEALTH FOCUS GROUP FOR OREGON HUMAN HEALTH-BASED WATER QUALITY CRITERIA.

Group	Species included in consumption rate evaluation	N	Statistic					
			Mean	Median	Percentile			
					75th	90th	95th	99th
Tulalip Tribe	Anadromous and estuarine finfish and shellfish	73	72	45	85	186	244	312
Suquamish Tribe	Anadromous and estuarine finfish and shellfish	284	214	132	NA	489	NA	NA
Squaxin Island Tribe	Anadromous and estuarine finfish and shellfish	117	73	43	NA	193	247	NA
Columbia River Tribes	Freshwater and anadromous finfish	512	63	40	60	113	176	389
Asians & Pacific Islanders	Anadromous and estuarine finfish and shellfish	202	117	78	139	236	306	NA
U.S. General Population	Freshwater, anadromous, estuarine, and marine finfish and shellfish	2585	127	99	NA	248	334	519

N = Number of adults in survey
NA= Statistical value not available.
Adults are 18 years or older for all surveys except Suquamish; Suquamish adults were 16 years or older
All values reported in this table are described in Table 1 (located at the end of this document)
Tulalip Tribes and Squaxin Island Tribe from Toy *et al.* 1996.
Suquamish Tribe from Suquamish. 2000.
Columbia River Treaty Tribes from CRITFC. 1994.
The Columbia River Tribes did not report marine fish consumption;
The 75, 90, 95 and, 99th percentiles are interpolated from percentiles reported in CRITFC 1994
Asian Pacific Islanders from Sechena *et al.* 1999.
US General Population from US EPA. 2002b.

The Human Health Focus Group only included fish consumption rates (Table 3) for adults in their recommended list of fish consumption rates. When fish consumption rates from these surveys are reported as grams per person per day, the consumption for children is lower than that of the adults and thus when expressed as an exposure value of grams per day, the adult levels may be protective of children. At this time the USEPA recommended water quality criteria are derived for adults with an average body weight of 70 kg (USEPA 2000a). With respect to exposure, children are particularly vulnerable compared to adults due to their lower body weight, differing metabolism, and behaviors. Thus it may be appropriate for the State of Oregon to develop water quality criteria for children.

Table 3 does not include the fish consumption rate of 17.5 g/day which is the basis for current Oregon water quality criteria. This number is considerably lower than the estimates recommended by the Human Health Focus Group because it was calculated in part by including people who don't eat fish and excluding Pacific salmon as well as other migratory and marine species. It is not an accurate estimate of long-term fish consumption rates for people who eat

fish. For example, the fish consumption rate of 248 g/day for the general population (USEPA 2002b) shown in Table 3 is more than 14 times greater than the current EPA default fish consumption rate (17.5 g/day) and more than double the 90th percentile (113 g/day) fish consumption rate for the Columbia River Basin Tribes (CRITFC 1994). For the U.S. general population, the mean seafood consumption rate for adults who consume fish is 127 g/day (+/- 6 g/day), while five percent of the adult population consumes 334 grams per day or more (+/- 15 g/day). These fish consumption rates are based on a sample of 2,634 adult consumers 18 years and older (USEPA 2002b, Section 5.2.1.1.Table 4.).

All the fish consumption rates in Table 3 are higher than the current 17.5 g/day fish consumption rate used in the current Oregon water quality criteria. The reason for this is that the Human Health Focus Group included only fish consumption rates for people who eat fish; and included all marine and migratory species described in the regional studies. The 90th and 95th percentile consumption rates for US fish consumers shown in Table 3 are consistent with, and are in fact greater than, the corresponding consumption levels documented in the Pacific Northwest regional studies identified by the Human Health Focus Group.

The Human Health Focus Group recommends selecting an Oregon fish consumption rate from a range of values that includes only those data for fish consumers (since this is about people who eat fish) and all types of fish (fresh water, estuarine, marine, and migratory finfish and shellfish). The national survey fish consumption survey (USEPA 2002b), is important to Oregon because the fish consumption rates from the national survey reflect the general U.S. population. Since there is no similar state-wide survey of all fish-consuming populations in Oregon, the national survey remains a relevant contextual piece of information for determining a change in the Oregon fish consumption rate.

The Human Health Focus Group discussed how recommendations for a fish consumption rate should be presented for use by Oregon. Scientists frequently present their scientific results in two ways, one to represent uncertainty and one to represent variability. Scientists present uncertainty information as 95 percent confidence levels around the mean which is based on the standard error calculation and which represents the uncertainty around the mean values.

For the types of issues the Human Health Focus Group considered in this report, variability in fish consumption rates, scientists usually present the 95th percentile which represents the variability of the population at two standard deviations from the mean (Kavloch *et al.* 1995). The majority of scientists on the Human Health Focus Group referred to this value when they discussed approaches for communicating how the fish consumption values could range for the Oregonian populations. One member used the 90th percentile as the point of reference. Both values are presented in Table 3.

Although the survey (cited here) of Japanese and Korean communities was not reviewed by the Human Health Focus Group because the results were not yet published, the results of the survey add to the conclusions made by the Human Health Focus Group about relevant fish consumption rates to recommend for the Oregon population.

Mercury Exposure from Fish Consumption within the Japanese and Korean Communities. Ami Tsuchiya, Thomas A. Hinners, Thomas M. Burbacher, Elaine M. Faustman, Koenraad Mariën. Journal of Toxicology and Environmental Health 2008 (in press).

Fish intake guidelines: Incorporating n-3 fatty acid intake and contaminant exposure in the Korean and Japanese communities. Ami Tsuchiya, Joan Hardy, Thomas M. Burbacher, Elaine M. Faustman, Koenraad Mariën. American Journal of Clinical Nutrition. 2008 (in press).

The survey, conducted by scientists at the Washington State Department of Health and University of Washington, assessed fish consumption in woman in Asian populations, Japanese and Korean, living in Western Washington. The results indicate fish consumption rates higher than the national average. The mean fish consumption rates for the Japanese and Korean populations (73 and 82 grams/day, respectively) fall within the range of mean rates of the surveys assessed by the Human Health Focus Group (shown in Table 3). The 95th percentile of the rates was 188 grams/day for the Japanese population and 230 grams/day for the Korean population. Both of these values also fall within the range of 95th percentiles of surveys assessed by the Human Health Focus Group (shown in Table 3) and thus provide additional support for Pacific Northwest fish consumption values of relevance for Oregon populations.

5.3 OREGON POPULATION-BASED FISH CONSUMPTION RATES

It is important to consider the number of Oregonians who are high consumers of seafood based upon the fish consumption rates shown in Table 3 of this report. In order to do this we have used estimates of the population based upon the 2003 Oregon Population Report of the Population Research Center at Portland State University. In these calculations, we assume that the Oregon population's dietary patterns are similar to the general U.S. population reported in Table 3. The data for the U.S. general population in Table 3 of this report, which comes from Section 5.2.1.1, Table 4, in USEPA Estimated Per Capita Fish Consumption in the United States August 2002b, is for adult consumers of seafood 18 years of age or older (n=2,634). Here, seafood is defined as finfish and shellfish from fresh, estuarine, and marine environments. The population of Oregon in 2003 was 2,655,700 adults, 18 years and older (see Table 9 of 2003 Oregon Population Report).

In the US EPA 2002 survey used to generate the general population fish consumption rates in Table 1 (located at the end of this document), 28 percent of the population interviewed were consumers (see Section 5.1.1.1 Figure 4 in USEPA Estimated Per Capita Fish Consumption in the United States August 2002b). In the study, participants were asked to recall their seafood consumption on two non-consecutive days and consumers were participants who ate seafood on at least one of the two days. Assuming the Oregon population is similar to the U.S. general population's diet, we estimate that there are:

2,665,700 X 28% = 746,400 adult Oregonians consuming fish.

If we consider high consumers of fish as being those at the 90th percentile and above (consuming at or above 248 grams of fish per day in Table 3 of this report) this would include:

746,400 X 10% = 74,640 adult Oregonians who are high consumers.

248 grams per day is equivalent to consuming 8.6 oz. of seafood per day, which is a plausible daily intake fish consumption rate for high consumers. This calculation only considers adult consumers and does not consider children who consume fish.

In 2003, the population of Oregonians under the age of 14 years old was 722,885. Applying the same calculation as that used for adults, children with a fish consumption rate of 191 grams of fish per day (USEPA 2002b, Section 5.2.1.1.Table 4)), would result in:

772,885 x 28% x 10%= 21,640 young Oregonians (under 15 years old) who are high consumers.

6. HUMAN HEALTH RISK AND WATER QUALITY CRITERIA

6.1 HUMAN HEALTH RISK

Risk assessment is the determination of the likelihood of adverse human health effects due to exposure to toxic chemicals. This determination is made by combining estimates of exposure through ingestion, inhalation, or skin absorption of a chemical with an estimate of toxic effects of that chemical. Exposure includes measures of duration and frequency of contact as well as body weight. Quantitative and qualitative estimates of exposure and toxicity are combined to estimate risk.

The lifetime probability of developing cancer for the American male is 1 in 2; for the American female it is 1 in 3 based on data from 2002-2004 (American Cancer Society 2008).

Toxicology provides information on the nature of the adverse effects that can be caused by the pollutant under consideration and the doses that cause the effect. Adverse health effects can range from immunological diseases to birth defects or cancer. The type of health effect caused by exposure to toxic chemicals has historically been divided into two categories based on the biological endpoints observed: 1) cancer and 2) non-cancer effects (e.g. neurological, cardiovascular, reproductive, developmental and immunological effects and blood and metabolic disorders). Toxicity information is usually obtained from animal experiments. Such studies can provide important dose-response information for identifying a reference dose for individual chemicals. The level of effect relates directly to the amount and duration of exposure. Studies of human populations can provide important information about sensitivity and variability of humans and can also provide information about exposure and the absorption, distribution, metabolism and excretion of chemicals in humans.

Non-cancer chemicals affect the function of various organ systems. The measure of effect for these chemicals is the reference dose. The reference dose is defined as an estimate of a daily oral exposure to a chemical by humans, including sensitive subpopulations, which are likely to be without an appreciable risk of causing adverse effects over a lifetime. Exposure below the reference dose is considered to be without statistically or biologically significant adverse effects. Once the reference dose is exceeded an individual is at increased risk of adverse health effects.

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. The cancer slope factor is measure of chemical potency.

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. Risk estimates for non-cancer causing chemicals are expressed as a hazard index or the ratio of the dose to the individual or population divided by a reference dose.

EPA records the most current scientific judgment on chemical toxicity in the Risk Integrated Information System (IRIS). IRIS is an electronic online data base maintained by EPA that provides chemical-specific risk information on the relationship between chemical exposures and estimated human health effects. The IRIS chemical files contain information on factors that are used in estimating risk or developing water quality such as oral Reference Doses (RfDs) and inhalation Reference Concentrations (RfCs) for chronic noncarcinogenic health effects; oral and inhalation cancer slope factors (CSF) and unit risks for chronic exposures to carcinogens; Drinking Water Health Advisories (HAs); EPA regulatory action summaries; and, supplementary data on acute health hazards and physical/chemical properties. More information on individual pollutants can be found online at: http://www.epa.gov/iriswebp/iris/index.html.

6.2 HUMAN HEALTH WATER QUALITY CRITERIA

A human health water quality criterion is the highest concentration of a pollutant in water that is not expected to pose a significant risk to human health. Human consumption of contaminated aquatic life is of primary concern because the presence of even extremely low ambient concentrations of bioaccumulative pollutants in surface waters can result in chemical residue concentrations in fish tissue that may pose a human health risk.

EPA's recommended procedures for developing human health criteria are provided in the revised *Methodology for Deriving Ambient Water Quality Criteria for the Protection of Human Health (USEPA 2000a).*

ODEQ has numeric human health-based water quality criteria for 130 toxic pollutants. Human health-based water quality criteria regulatory limits are derived for: 1) cancer and 2) non-cancer effects. In the case of carcinogens:

> "the [ambient water quality criterion] represents the water concentration that would be expected to increase an individual's lifetime risk of carcinogenicity from exposure to the particular pollutant by no more than one chance in one million, regardless of the additional lifetime cancer risk due to exposure, if any, to that particular substance from other sources." (USEPA 2000a)

The acceptable level of cancer risk is usually expressed as an incremental cancer risk or an additional cancer risk.

The mathematical estimation of risk is different for carcinogenic and non-carcinogenic biological endpoints (Equations 1 and 2). When developing water quality criteria, the regulatory agency establishes the acceptable risk level and then determines the concentration in water and fish tissue that will not exceed the acceptable risk levels.

Exposure scenarios for the derivation of human health-based water quality criteria address two types of exposure: 1) combining ingestion of fish and surface water, and 2) ingestion of fish alone. Exposure factors include: bioconcentration, body weight, drinking water ingestion rate, and fish ingestion rates. Other exposure route information (skin absorption, other dietary sources, inhalation, etc) should be considered and incorporated into human exposure evaluations as the RSC values.

EPA generally assigns a mix of central tendency values (e.g., average for the population) and high end values (e.g., 90th or 95th percentiles) for exposure factors such as ingestion rates and body weight. For the purposes of developing water quality criteria EPA uses an average adult body weight of 70 kg. The water quality criteria equations (Equations 1 and 2) for chemical exposure are defined as body weight divided by the drinking water intake rate added to the fish ingestion rate, multiplied by the bioconcentration of the chemical from water into fish tissue.

For carcinogens, the water quality criteria are calculated by dividing the acceptable risk level by the rate of tumor production (cancer slope factor). This estimate of toxicity is then multiplied by the chemical exposure to estimate risk (Equation 1). The regulatory agency or other decision makers prescribe the acceptable risk level. ODEQ established an acceptable cancer risk level of an additional one in one million chance of developing cancer.

> The bioconcentration factor (BCF accounts for the uptake by fish or shellfish of a pollutant from the surrounding water. Units of liters/kg (L/kg)

The following description of the estimation of the water quality criteria for dioxin and DDT illustrates the relationship of toxicity, the fish consumption rate, and the bioconcentration factor with the ambient water quality criterion. Dioxin (cancer slope factor 156,000 per mg/kg-day) is much more potent than DDT (cancer slope factor 0.34 per mg/kg-day). DDT has a higher bioconcentration factor (53,600 L/kg) than dioxin (5,000 L/kg). Using the current ODEQ fish consumption rate of 17.5 grams per day the water quality criterion for dioxin will be 0.00000000513 µg/L; DDT will be 0.000219 µg/L. Even though the uptake of DDT into fish tissue is greater than the uptake of dioxin the high toxicity of dioxin results in a lower ambient water quality criterion.

If the fish consumption rate were increased by ten to 175 grams per day the water quality criterion for dioxin would be 0.000000000513 µg/L; 0.0000219 µg/L for DDT. Thus, if someone eats ten times more fish than the current ODEQ rate of 17.5 grams/day they would exceed the Oregon acceptable cancer risk level of an additional one in one million chance of developing cancer. Their risk of developing cancer from exposure to dioxin or DDT would be one in one hundred thousand.

Equation 1 ***Cancer***

$$AWQC = Risk/CSF \cdot \left[\frac{BW}{DI + [FCR \cdot BCF]} \right]$$

Equation 1 ***Cancer Dioxin***

$$0.00000000513\ \mu g/L = 156{,}000/mg/kg/day \cdot \left[\frac{70\ kg}{2\ L/day + [17.5\ g/day \cdot 5{,}000\ L/kg]} \right]$$

Equation 1 ***Cancer DDT***

$$0.000219\ \mu g/L = 0.34/mg/kg/day \cdot \left[\frac{70\ kg}{2\ L/day + [17.5\ g/day \cdot 53{,}600\ L/kg]} \right]$$

AWQC = Ambient Water Quality Criteria (µg/L)
BW = Body Weight (kg)
DI = Drinking Water Intake (L/day)
FCR = Fish Consumption Rate (kg/day)
BCF = Bioconcentration Factor of chemical from water to fish tissue (L/kg)
Risk = Acceptable Cancer Risk Level (Oregon = an additional one in one million chance of developing cancer)
CSF = Cancer Slope Factor

For chemicals with a reference dose, the water quality criteria are calculated by multiplying the reference dose times the chemical exposure (Equation 2). The RSC is either subtracted from the reference dose if the concentration of the chemical in other media is known (methylmercury Appendix C) or a percentage of the exposure is attributed to freshwater and estuarine fish and shellfish consumption (20 percent). The effect of toxicity, the fish consumption rate, the bioconcentration factor, and the RSC on the determination of water quality criteria for chemicals with a reference dose is illustrated by the following examples for endrin and pyrene.

The reference dose for the pesticide endrin is 0.0003 mg/kg/day. In addition only a fraction (20 percent) of the exposure to endrin is attributed to freshwater and estuarine fish and shellfish. The primary source of endrin is from its presence in air, water, sediment, soil, fish, and other aquatic organisms (Appendix C). The bioconcentration factor for endrin is 3,970 L/kg. The reference dose for pyrene is 0.03 mg/kg/day. The bioconcentration factor for pyrene is 30 L/kg. With the current ODEQ fish consumption rate of 17.5 grams per day, the water quality criterion for endrin is 0.0605 µg/L; the water quality criterion for pyrene is 4,000 µg/L. Endrin's higher toxicity and bioconcentration factor result in a lower water quality criterion for endrin than pyrene. If the fish consumption rate were increased 10 times to 175 grams per day the water quality criterion for

endrin would be 0.00605 µg/L; for pyrene it would be 400 µg/L. The people who eat ten times more fish than the current fish consumption rate would exceed the reference dose by ten.

ODEQ established the level of protection from exposure to chemicals with a reference dose as equal to or less than the reference dose for a specific chemical. The reference dose for endrin is based on adverse effects to the liver; for pyrene its adverse health effects to the kidney. Thus people who eat more than 17.5 grams per day would be at risk to adverse effects to their kidney or liver.

Equation 2 ***Non - Cancer***

$$AWQC = RFD \cdot RSC \cdot \left[\frac{BW}{DI + [FCR \cdot BCF]} \right]$$

Equation 2 ***Non - Cancer Endrin***

$$0.0605\ \mu g/L = 0.0003\ mg/kg/day \cdot 0.2 \cdot \left[\frac{70\ kg}{2L/day + [17.5\ g/day \cdot 3{,}970\ L/kg]} \right]$$

Equation 2 ***Non - Cancer Pyrene***

$$4000\ \mu g/L = 0.03\ mg/kg/day \cdot \left[\frac{70\ kg}{2L/day + [17.5\ g/day \cdot 30\ L/kg]} \right]$$

AWQC = Ambient Water Quality Criteria (µg/L)
BW = Body Weight (kg)
DI = Drinking Water Intake (L/day)
FCR = Fish Consumption Rate (kg/day)
BCF = Bioconcentration Factor of chemical from water to fish tissue (L/kg)
RFD = Reference Dose (mg/kg/day)
RSC = Relative Source Contribution

6.3 SENSITIVE POPULATIONS AND TOXICITY

The Human Health Focus Group discussed populations that may be more susceptible to environmental toxicants due to special exposure circumstances or sensitivity to the toxicity of certain pollutants. Of importance is early *in utero* and post-natal exposure of infants and children, and the elderly. There are critical periods of fetal development and the effects of prenatal chemical exposures will differ depending on the dose and the timing of the exposure (Needham *et al.* 2008). These populations include fetuses, children, and the elderly. With

respect to exposure, children are particularly vulnerable as compared to adults due to their lower body weight, differing metabolism, and behaviors.

The human health-based water quality criteria are calculated using a default adult male body weight of 70 kilograms. For chemical exposure you need to know not only the amount and rate of chemical intake but also body weight. Chemical exposure is expressed relative to body weight and is calculated from the concentration of chemical in fish tissue and the frequency and duration of fish consumption. In the case of adult males (18-74 years of age), mean body weight is 78 kg (172 lbs), with 5th and 95th percentile weights of 59kg (130 lbs) to 103 kg (227 lbs), respectively. Mean adult female body weight for the same age range is 65 kg (143 lbs), with 5th and 95th percentiles of 48 kg (106 lbs) and 93 kg (205 lbs), respectively (USEPA 1997).

The variation of weight between children and adults is significant, considering that newborns typically weigh 4 kg (8 lbs) while adults can reach weights of 113 kg (250 lbs). Thus, risk estimates for children versus adults can vary considerably. In the current water quality criteria guidance EPA recommends using an average adult body weight of 70 kg (154 lbs) as a default body weight value in the water quality criteria calculations. While use of water quality criteria based on the adult default weight provides adequate protection for adults, it may not provide adequate protection for children.

As discussed in USEPA 2000a, the EPA encourages states and authorized tribes to use alternative body weight assumptions for population groups other than the general population and to use local or regional data for its calculations. In the case of children, EPA's water quality guidance (USEPA 2000a) recommends using 30 kg (66 lbs)as a default children's body weight to provide additional protection for children when chemicals of concern indicate that health effects (i.e developmental neurotoxicity, immunotoxicity, etc.) may be of particulate concern for these early ages. As this would potentially be the case for chemicals to be considered under Oregon's water quality standards, we have included Table 4 which lists fish consumption per body weight per children.

In the surveys reviewed for this report, the consumption rate for children was quite variable. In all cases the consumption rate for children was less than that for adults on a gram-per-day basis (Table 1, located at the end of this document). However, when the rates were computed with individual body weight, the children's levels included levels greater than the adults (Table 4). Note that in Tables 4 a, b, c and d, the grams of fish consumed per kg body weight per day for children at ages 6 and under all had 90th or 95th percentile values approximately 2-fold higher than those listed for the adult 90th and 95th percentile values except for the Tulalip and Squaxin Island tribes. Thus, these figures suggest the need to consider greater fish consumption rates than adult rates to ensure full protection of children specific exposure factors.

The potential for toxicity and adverse health outcomes varies with life stage and/or health status. Toxicity values should incorporate consideration of developmental life stages that might be particularly vulnerable. The information is then incorporated into a risk assessment. For humans, early life stages (e.g. fetus, infant) may be vulnerable to toxic chemical effects due to immature or developing metabolic and organ

Children: Children in this document refer to birth through adolescence (16-18 years).

systems. Effects that are reversible in adults may not be reversible during the developmental stage. The concern for women of child bearing age is risk to offspring during development. There is also concern for the elderly who may be more susceptible than younger adults because of their reduced capacity for recovery due to illness, age, or ability to eliminate or metabolize chemicals. There are also people whose existing health condition (e.g. immune suppression, asthma) may exacerbate the harmful affects of toxic chemicals.

In many cases, the toxicity of chemicals is derived from laboratory studies of animals. Depending on the pollutant of interest, some of these studies consider sensitive populations, and other studies may not. Many of the toxicity values are in fact based on doses for adults so there is no direct correlation between toxicity and life stage. EPA's Integrated Risk Information System database provides information on how the toxicity of each pollutant was derived.

TABLE 4. FISH CONSUMPTION RATES (PER BODY WEIGHT) FOR CHILDREN

Table 4a. All fish g/kg-body weight/day (excerpt from Section 4.1.1.2, Table 3 and Table 5 USEPA 2002b)

Consumers and non consumers

Age (years)	N	Mean	Median	90%	95%
3 to 5	4112	0.29		1.10	2.00
6 to 10	1553	0.21		0.78	1.40
11 to 15	975	0.16		0.57	1.10
15 to 44	4644	0.19		0.71	1.10
>44	5333	0.24		0.84	1.30

Table 4b. All fish g/kg- body weight/day (excerpt from Tables T-3 and T-14 Suquamish 2000)

Children's rate varied from zero consumption of certain shellfish to 100% consumption for salmon

Age (years)	N	Mean	Median	90%	95%
0 to 6	31	1.5		3.4	
16 to >55	92	2.7		6.2	

TABLE 4. FISH CONSUMPTION RATES (PER BODY WEIGHT) FOR CHILDREN (CONTINUED)

Table 4c.All fish g/kg-body weight/ day (excerpt from Table 3 and Table 8, Toy *et al.* 1996)

Non-consumers for children was 29% for Tulalip Tribes and 25% for Squaxin Island Tribe

Tulalip Tribes					
Age (years)	**N**	**Mean**	**Median**	**90%**	**95%**
0 to 5	21		0.08	0.74	
18 to >65	73	0.89	0.55		2.88
Squaxin Island Tribe					
Age (years)	**N**	**Mean**	**Median**	**90%**	**95%**
0 to 5	48		0.51	2.06	
18 to >65	117	0.89	0.52		3.01

Table 4d. All fish mg/kg-body weight/day (excerpt from Section 5.2.1.2., Table 3 and Table 5 (USEPA 2002b)

Consumers only					
Age (years)	**N**	**Mean**	**Median**	**90%**	**95%**
3 to 5	779	4.20	3.60	8.00	10.00
6 to 10	250	3.20	2.50	6.50	8.70
11 to 15	164	2.20	1.60	4.40	6.20
15 to 44	1102	1.80	1.40	3.50	4.80
>44	1567	1.70	1.40	3.40	4.30
N=Number of people in survey					

NOTE: As with all studies, when measured body weight values are not available for individual study/survey participants, caution must be taken as evaluations of retrospectively added default body weight values can be shown to have potential to both over as well as under estimate relative exposures (Marien *et al.* 2005).

6.4 CHEMICAL INTERACTIONS

Exposure to mixtures of chemicals poses a special circumstance for toxicologists. Individual chemicals may interact in a variety of ways. The impact of multiple chemicals on toxicological response can be additive (e.g., toxicity by the same mode of action), less-than-additive (e.g., zinc inhibits cadmium toxicity by reducing the amount of cadmium absorbed), or greater-than additive (e.g., enhanced carcinogenicity for asbestos and tobacco smoke) (USEPA, 2000b). Chemical interactions may also include antagonistic interactions as well as no influence (USEPA 2000b).

Human health-based water quality criteria are calculated for individual chemicals. The calculated risk of any single chemical does not take into account the interaction of chemical mixtures that may occur when people are exposed to multiple chemicals simultaneously. Thus, human health-based water quality criteria do not take potential exposure to multiple chemicals into account.

The number of complex mixtures that may be found in the environment and concomitantly in fish tissue is difficult to predict. Thus, development of an interactive scheme for all possible chemical combinations is impossible. While the Human Health Focus Group recognizes this limitation, the lack of accounting for chemical interactions is a shortfall in the overall protectiveness of the human health-based water quality criteria. The Human Health Focus Group recommends that there be an accounting for this interaction when criteria are used to establish limits for specific regulatory actions (e.g. Total Maximum Daily Loads, water quality permits, hazardous waste cleanup) where the chemical regime is known.

In addition to concerns with potential exposure regarding the unknown interaction of multiple pollutants in fish tissue that is ingested there are the potential benefits that may occur through the concurrent ingestion of nutrients present in certain fish tissue, such as omega-3-fatty acids (e.g. docosahexaenoic acid and eicosapentaenoic acid) (Oken *et al.* 2005).

7. CONCLUSIONS

The following conclusions are based on the review of the fish consumption surveys discussed in this report as well as the expertise of the Human Health Focus Group.

The Human Health Focus Group was asked to respond to three questions posed by ODEQ, The Confederated Tribes of the Umatilla Reservation and EPA as part of the Fish Consumption Rate Project. The three questions were:

1) Considering the available local, regional and national information on fish consumption, what is the scientific evidence Oregon should rely on when selecting a fish consumption rate to use in setting water quality criteria?
2) How should Pacific salmon be considered in selecting a fish consumption rate and/or setting criteria?
3) To what extent are populations who consume more than the current fish consumption rate of 17.5 grams per day (g/day) at a greater risk for adverse health impacts?

1) Considering the available local, regional and national information on fish consumption, what is the scientific evidence Oregon should rely on when selecting a fish consumption rate to use in setting water quality criteria?

The Human Health Focus Group was able to identify multiple regionally relevant studies of high quality for selecting a fish consumption rate. Indeed, these studies cover not only the Pacific Northwest but the United States and the globe. Each of these studies provides a fresh view of the amount of fish that people consume over their lifetime. The national and international studies, provided as additional references, confirm the view that the level of fish consumption is quite similar across different cultures and countries. The specific types of fish consumed varies across populations.

The Human Health Focus Group reduced its list of nine relevant studies to five that are most useful for recommending fish consumption rate(s) to ODEQ, EPA, and CTUIR. Within these studies there is definitely enough information to provide the State of Oregon with reliable estimates of risk. While these surveys were not specifically done for the people of Oregon, they provide a relevant and reliable range of rates that may be considered by the state.

The Human Health Focus Group also agreed that:

- The current fish consumption rates may be suppressed due to pollution and/or decreased fish abundance
- The current rate of 17.5 grams per day does not reflect Oregon or US population fish consumption rates
- The fish consumption rate should include fish consumers only
- All types of fish should be included in the fish consumption rate regardless of whether they were bought or locally harvested
- An upper-bound fish consumption rate(s) (90 percent or 95 percent, Table 3) should be adopted by ODEQ for Oregon fish consumers

2) *How should Pacific salmon be considered in selecting a fish consumption rate and/or setting criteria?*

The Human Health Focus Group unanimously agreed Pacific salmon should be included in the fish consumption rate. They generally are the primary choice of fish for most fish consumers in the Pacific Northwest.

The RSC factor is not sufficiently defined to allow accounting for contaminant exposure through consumption of Pacific salmon or marine species. All members of the Human Health Focus Group agreed that data available in the surveys reviewed by the Human Health Focus Group did not distinguish between near shore marine species and deep ocean species. Therefore, the recommended fish consumption rate should include all types of marine species since the open ocean and near shore species typically found in Oregon could not be differentiated in the studies reviewed.

3) *To what extent are populations who consume more than the current fish consumption rate of 17.5 grams per day (g/day) at a greater risk for health impacts?*

The Human Health Focus Group finds that the current fish consumption rate would leave a proportion of the population of Oregon without protection. People who eat more than 17.5 grams per day are at an increased risk of heart, kidney or liver disease, neurological and developmental effects, cancer, and other health effects. This is a particular concern for vulnerable populations based on age, gender, or health status. The level of concern increases with higher fish consumption rates and for children as the relative consumption per body weight increases over these relative values in adults.

In summary, people who eat more than 17.5 g/day of fish and shellfish will exceed the reference dose, or the level which is considered acceptable by EPA and at which there are no expected adverse health effects. The extent and specificity of that risk is dependent upon the toxicity of the individual chemical and cannot be easily quantified without specific pollutant considerations. People consuming more than 17.5 g/day of fish will also exceed the Oregon acceptable cancer risk level of an additional one in one million chance of developing cancer established by the ODEQ.

TABLE 1. COMPARISON OF FISH CONSUMPTION RATES

NOTE: THE COLUMN SEAFOOD SOURCE REFERS TO WHETHER FISH WERE HARVESTED LOCALLY OR PURCHASED.
THE COLUMN SEAFOOD SPECIES REFERS TO ALL TYPES OF FISH FROM A VARIETY OF HABITATS.

line #	Group	Subgroup = gender or age	Fish Consumer only / fish Consumer + Non Consumer	Seafood Source	Seafood Species included in consumption rate evaluation	Statistic (grams/day)						Reference
								Percentile				
						Mean	Median	75th	90th	95th	99th	
	Surveys reviewed by the HHFG											
1	Tulalip Tribes[a]	Children (0-5 years old)	Consumer only	All	Anadromous & resident finfish & shellfish	3.6	1.2	4.5	11.2			Toy et al 1996
2	Squaxin Island Tribe[v]	Children (0-5 years old)	Consumer only	All	Anadromous & resident finfish & shellfish	12.5	7.7	18.2	31.3			Toy et al 1996
3	Suquamish Tribe[u]	Children (9 months to 6 years old)	Consumer only	All	Anadromous & resident finfish & shellfish	24	12		57			Toy et al. 1996
4	Columbia River Tribes[p]	Children (0-5 years old)	Consumer only	All	Anadromous & resident fish	19.6		~22	~40	~68	~129	CRITFC 1994
5	Columbia River Tribes - Reevaluation of data[aa]	Children (0-5 years old)	Consumer only	All	Anadromous & resident fish	26.7	16.2		64.8	81	162	CRITFC 1994

TABLE 1. COMPARISON OF FISH CONSUMPTION RATES

NOTE: THE COLUMN SEAFOOD SOURCE REFERS TO WHETHER FISH WERE HARVESTED LOCALLY OR PURCHASED.
THE COLUMN SEAFOOD SPECIES REFERS TO ALL TYPES OF FISH FROM A VARIETY OF HABITATS.

line #	Group	Subgroup = gender or age	Fish Consumer only / fish Consumer + Non Consumer	Seafood Source	Seafood Species included in consumption rate evaluation	Statistic (grams/day)						Reference
								Percentile				
						Mean	Median	75th	90th	95th	99th	
6	U.S. General Population[q]	Children (3-5 years old)	Consumer + Non-consumer	All	Resident finfish & shellfish from fresh and estuarine environments	2.19		NA	0.05	12.2	52.46	USEPA 2002
7	U.S. General Population[q]	Children (3-5 years old)	Consumer + Non-consumer	All	Anadromous & resident finfish & shellfish from fresh, estuarine, and marine environments	7.7		NA	32.56	51	100	USEPA 2002
8	U.S. General Population[r]	Children (3-5 years old)	Consumer only	All	Anadromous & resident finfish & shellfish from fresh, estuarine, and marine environments	74	64	NA	149	184	363	USEPA 2002
9	U.S. General Population[r]	Children (3-5 years old)	Consumer only	All	Resident finfish & shellfish from fresh and estuarine environments	40	23	NA	95	129	205	USEPA 2002
10	Lake Whatcom (WA) Fisherman[x]	Children	Consumer only	Lake Whatcom (WA)	Resident fish		3.6					WDOH 1997

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line #	Group	Subgroup = gender or age	Fish Consumer only / fish Consumer + Non Consumer	Seafood Source	Seafood Species included in consumption rate evaluation	Statistic (grams/day)						Reference
								Percentile				
						Mean	Median	75th	90th	95th	99th	
11	Columbia River Tribes[o]	Women who have breastfed (36% of survey respondents)	Consumer only	All	Anadromous & resident fish	59.1		~58.5	~112	~174	~278	CRITFC 1994
12	U.S. General Population[s]	Women (15-44 years old)	Consumer only	All	Anadromous & resident finfish & shellfish from fresh, estuarine, and marine environments	108	77	NA	221	315	494	USEPA 2002
13	U.S. General Population[t]	Women (15-44 years old)	Consumer only	All	Resident finfish & shellfish from fresh and estuarine environments	75	36	NA	172	273	502	USEPA 2002
14	Tulalip Tribes[a]	Adults	Consumer only	All	Anadromous & resident finfish & shellfish	72	45	85	186	244	312	Toy et al 1996
15	Tulalip Tribes[a]	Adults	Consumer only	Harvested anywhere	Anadromous & resident finfish & shellfish	63	37	80	159	236	311	Toy et al 1996
16	Tulalip Tribes[a]	Adults	Consumer only	Harvested from Puget Sound	Anadromous & resident finfish & shellfish	54	30	74	139	194	273	Toy et al 1996

TABLE 1. COMPARISON OF FISH CONSUMPTION RATES

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line #	Group	Subgroup = gender or age	Fish Consumer only / fish Consumer + Non Consumer	Seafood Source	Seafood Species included in consumption rate evaluation	Statistic (grams/day)						Reference
								Percentile				
						Mean	Median	75th	90th	95th	99th	
17	Tulalip Tribes[a]	Adults	Consumer only	All	Resident finfish & shellfish	36	18	41	116	132	168	Toy et al 1996
18	Tulalip Tribes[a]	Adults	Consumer only	Harvested anywhere	Resident finfish & shellfish	32	14	40	103	116	157	Toy et al 1996
19	Tulalip Tribes[a]	Adults	Consumer only	Harvested from Puget Sound	Resident finfish & shellfish	31	14	39	90	113	157	Toy et al 1996
20	Squaxin Island Tribe[v]	Adult males	Consumer only	All	All Fish and shellfish	73	NA	NA	165	249	NA	Toy et al 1996
2	Squaxin Island Tribe[v]	Adult females	Consumer only	All	All Fish and shellfish	70	NA	NA	220	274	NA	Toy et al 1996
22	Suquamish Island Tribe[b]	Adults (16 or older)	Consumer only	All	Anadromous & resident finfish & shellfish	214	132		489	NA	NA	Suquamish 2000
23	Suquamish Tribe[c]	Adults (16 or older)	Consumer only	Harvested from Puget Sound	Anadromous & resident finfish & shellfish	165	58	221	397	767	NA	Suquamish 2000
24	Suquamish Tribe[c]	Adults (16 or older)	Consumer only	Harvested from Puget Sound	Resident finfish & shellfish	126	49	116	380	674	NA	Suquamish 2000

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line #	Group	Subgroup = gender or age	Fish Consumer only / fish Consumer + Non Consumer	Seafood Source	Seafood Species included in consumption rate evaluation	Statistic (grams/day)						Reference
								Percentile				
						Mean	Median	75th	90th	95th	99th	
25	Columbia River Tribes[d]	Adults	Consumer only	All	Anadromous & resident fish	63	40	60[e]	113[f]	176[g]	389	CRITFC 1994
26	Columbia River Tribes[m]	Adults	Consumer + Non-consumer	All	Anadromous & resident fish	58.7	~40	~57	~113	170	389	CRITFC 1994
27	Columbia River Tribes[n]	Adults	Consumer only	All	Resident fish	~43		~41	~82	~124	~284	CRITFC 1994
28	Asians & Pacific Islanders[h]	Adults	Consumer only	All	Anadromous & resident finfish & shellfish	117	78	139	236	306	NA	Sechena et al 1999
29	Asians & Pacific Islanders[h]	Adults	Consumer only	Harvested anywhere	Anadromous & resident finfish & shellfish	16	7	16	49	76	NA	Sechena et al 1999
30	Asians & Pacific Islanders[h]	Adults	Consumer only	Harvested from King County	Anadromous & resident finfish & shellfish	14	6	15	26	57	NA	Sechena et al 1999

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line #	Group	Subgroup = gender or age	Fish Consumer only / fish Consumer + Non Consumer	Seafood Source	Seafood Species included in consumption rate evaluation	Statistic (grams/day)						Reference
								Percentile				
						Mean	Median	75th	90th	95th	99th	
31	Asians & Pacific Islanders[h]	Adults	Consumer only	Harvested anywhere	Resident finfish & shellfish	16	7	18	54	72	NA	Sechena et al 1999
32	Asians & Pacific Islanders[h]	Adults	Consumer only	Harvested from King County	Resident finfish & shellfish	14	7	16	33	57	NA	Sechena et al 1999
33	U.S. General Population[i]	Adults (18 or older)	Consumer + Non-consumer	All	Resident freshwater/estuarine finfish & shellfish[j]	8	0	NA	17	50	143	USEPA 2002
34	U.S. General Population[k]	Adults (18 or older)	Consumer + Non-consumer	All	Anadromous & resident finfish & shellfish from fresh, estuarine, and marine environments	20	0	NA	75	111	216	USEPA 2002
35	U.S. General Population[l]	Adults (18 or older)	Consumer only	All	Anadromous & resident finfish & shellfish from fresh, estuarine, and marine environments	127	99	NA	248	334	519	USEPA 2002
36	U.S. General Population[l]	Adults (18 or older)	Consumer only	All	Resident finfish & shellfish from fresh and estuarine environments	81	47	NA	199	278	505	USEPA 2002

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line #	Group	Subgroup = gender or age	Fish Consumer only / fish Consumer + Non Consumer	Seafood Source	Seafood Species included in consumption rate evaluation	Statistic (grams/day)						Reference
								Percentile				
						Mean	Median	75th	90th	95th	99th	
37	Columbia Slough Fisherman[w]	Adults	Consumer only	Columbia Slough	Resident finfish & shellfish from fresh and estuarine environments		24	36				Adolfson Associates 1996
38	Sauvie Island Fisherman[w]	Adults	Consumer only	Sauvie Island	Anadromous & resident finfish & shellfish from fresh and estuarine environments		4	6				Adolfson Associates 1996
39	Lake Whatcom (WA) Fisherman[x]	Adults	Consumer only	Lake Whatcom (WA)	Resident fish	6						WDOH 1997
40	Lake Roosevelt (WA) Fisherman[y]	Adults	Consumer only	Lake Roosevelt (WA)	Resident fish	42					90[z]	WDOH 1997
Angler surveys in the U.S. - useful references - surveys not reviewed by the HHFG												
41	Michigan licensed anglers	Adults	Consumer + Non-consumer	harvested locally	fresh water fish	27		35	73	102		West, 93

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line #	Group	Subgroup = gender or age	Fish Consumer only / fish Consumer + Non Consumer	Seafood Source	Seafood Species included in consumption rate evaluation	Statistic (grams/day)						Reference
								Percentile				
						Mean	Median	75th	90th	95th	99th	
42	Michigan licensed anglers	Adults	Consumer + Non-consumer	harvested locally	fresh water fish	17		20	61	82	489	West, 93
43	S. Carolina	Adults	Consumer + Non-consumer	harvested locally	fresh water fish	48						[ab]Jurer et al 1999
44	Michigan	Adults	Consumer + Non-consumer	harvested locally	fresh water fish	27						Chan et al 1999 Having et al 1992 reported in Chan et al 1999
45	Great Lakes	Adults	Consumer + Non-consumer	harvested locally	fresh water fish	21						Chan et al 199 Health Canada 1995 reported in Chan et al 1999
46	Santa Monica Bay (CA) Seafood consumers	anglers who ate fish from Santa Monica Bay	consumer only	harvested locally	All self caught species	50	21		107			SCCWRP and MBC (1994)
Native American - useful references												
47	Lakes Huron, Michigan, Superior	Adults	subsistence-recall	harvested locally	fresh water fish	62						[ac]Dellinger 2004

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line #	Group	Subgroup = gender or age	Fish Consumer only / fish Consumer + Non Consumer	Seafood Source	Seafood Species included in consumption rate evaluation	Statistic (grams/day)						Reference
								Percentile				
						Mean	Median	75th	90th	95th	99th	
48	Lake superior	Adults	subsistence-recall	harvested locally	fresh water fish	60						[ad]Dellinger 2004
49	Inland Lakes	Adults	subsistence-recall	harvested locally	fresh water fish	46						[ad]Dellinger 2004
50	Menominee	Adults	subsistence-recall	harvested locally	fresh water fish	34						[ad]Dellinger 2004
51	Other Res	Adults	subsistence-recall	harvested locally	fresh water fish	87						[ad]Dellinger 2004
52	All tribes	Adults	subsistence-recall	harvested locally	fresh water fish	60						[ad]Dellinger 2004
53	Lakes Huron, Michigan, Superior	Adults	subsistence-actual	harvested locally	fresh water fish	4						[ad]Dellinger 2004
54	Lake superior	Adults	subsistence-actual	harvested locally	fresh water fish	11						[ad]Dellinger 2004
55	Inland Lakes	Adults	subsistence-actual	harvested locally	fresh water fish	8						[ad]Dellinger 2004
56	Menominee	Adults	subsistence-actual	harvested locally	fresh water fish	34						[ad]Dellinger 2004

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line #	Group	Subgroup = gender or age	Fish Consumer only / fish Consumer + Non Consumer	Seafood Source	Seafood Species included in consumption rate evaluation	Statistic (grams/day)						Reference
								Percentile				
						Mean	Median	75th	90th	95th	99th	
57	Other Res	Adults	subsistence-actual	harvested locally	fresh water fish	8						[ad]Dellinger 2004
58	All tribes	Adults	subsistence-actual	harvested locally	fresh water fish	8						[ad]Dellinger 2004
59	Mohawk, Montreal	Adults	consumers	harvested locally	fresh water fish	33						[ae]Chan et al, 1999
60	Mohawk, Montreal	Adults	Consumer + Non-consumer	harvested locally	fresh water fish	23						[ae]Chan et al, 1999
61	Akwasasne	Adults	Consumer + Non-consumer	harvested locally	fresh water fish	25						Chan et al 1999 Forti et al 1995 reported in Chan et al 1999
62	Wisconsin Chippewa	Adults	Consumer + Non-consumer	harvested locally	fresh water fish	26						Chan et al Peterson et al 1994 reported in Chan et al 1999 Burger et al 1999;
63	Ojibwa	Adults	Consumer + Non-consumer	harvested locally	fresh water fish	23						Dellinger et al 1997 reported in Burger et al 1999

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line #	Group	Subgroup = gender or age	Fish Consumer only / fish Consumer + Non Consumer	Seafood Source	Seafood Species included in consumption rate evaluation	Statistic (grams/day)						Reference
						Mean	Median	Percentile 75th	Percentile 90th	Percentile 95th	Percentile 99th	
64	Canadian First Nation	All ages	consumers	harvested locally	salmon only	28						[am]Mos et al, 2004
65	Canadian First Nation	All ages	consumers	harvested locally	salmon only	48						[af]Mos et al, 2004
66	Canadian First Nation	All ages	consumers	harvested locally	all marine species including salmon	44						[af]Mos et al, 2004
World												
67	Japan	Adults	Consumer + Non-consumer	All	fresh water and marine fish & shellfish	96						[ag]Nakagawa et al, 1997 (1976 data from Kitamura et al 1976)
68	Japan	Adults	Consumer + Non-consumer	All	fresh water and marine fish & shellfish	163						[ag]Nakagawa et al, 1997
69	Hong Kong	Adults	Consumer + Non-consumer	All	fresh water and marine fish & shellfish	52						[ah]Dickman and Leung, 1998

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line #	Group	Subgroup = gender or age	Fish Consumer only / fish Consumer + Non Consumer	Seafood Source	Seafood Species included in consumption rate evaluation	Statistic (grams/day)						Reference
						Mean	Median	Percentile 75th	Percentile 90th	Percentile 95th	Percentile 99th	
70	Hong Kong	Adults	Consumer + Non-consumer	All	fresh water and marine fish & shellfish	164						[ah] Dickman and Leung, 1998 extracted from Euromonitor 1997

Footnotes:

[a] Values computed from Toy et al. 1996 study data (Kissinger 2003).
[b] Values g/kg/day for "all seafood" taken from Table T-3 of the Suquamish Survey (Suquamish 2000) and converted to g/day by multiplying by the average body weight for men and women of 79 kg
[c] Values computed by ShiQuan Liao and Nayak Polissar of the Mountain Whisper Light Statistical Consulting company for the Suquamish Tribe (Liao and Polissar 2007)
[d] Values compiled from Table 10 "Number of Grams per Day Consumed by Adult Fish Consumers" of the Columbia River Intertribal Fish Commission Study (CRITFC 1994)
[e] A value of 60 g/day was derived by linearly interpolating between the consumption rate/cumulative percentiles bracketing the 75th percentile (48.6 g/day, 65.1%) and (64.8 g/day, 79.1%)
[f] A value of 113 g/day was derived by linearly interpolating between the consumption rate/cumulative percentiles bracketing the 90th percentile (97.2 g/day, 88.5%) and (130 g/day, 91.6%)
[g] A value of 176 g/day was derived by linearly interpolating between the consumption rate/cumulative percentiles bracketing the 95th percentile (170 g/day, 94.4%) and (194 g/day, 97%)
[h] Values computed from 1999 EPA Asian Pacific Islander seafood consumption survey data (Kissinger 2005). Kissinger (2005) converted mixed cooked and raw wet weight consumption rate information from the 1999 publication into a wet weight consumption rate.
[i] Values taken from EPA 2002 Section 5.1.1.1, Table 4: Uncooked fish consumption estimates, U.S. Population – Finfish and Shellfish, Individuals Age 18 and Older. Values from the "freshwater/estuarine" section of the table are used.
[j] Pacific salmon were assigned to consumption of marine species rather than estuarine species (SEE Section 2.1.1 of EPA 2002 for an explanation).
[k] Values taken from EPA 2002 Section 5.1.1.1, Table 4: Uncooked fish consumption estimates, U.S. Population – Finfish and Shellfish, Individuals Age 18 and Older. Values from the "all fish" section of the table are used.
[l] Values taken from EPA 2002 Section 5.2.1.1, Table 4: Uncooked fish consumption estimates, U.S. Population – Finfish and Shellfish, Individuals Age 18 and Older. Values from the "all fish" section of the table are used.
[m] Values compiled from Table 7 "Number of Grams per Day of Fish Consumed by Adult Respondents (Fish consumers and non-fish consumers) combined - Throughout the year" of the Columbia River Intertribal Fish Commission Study (CRITFC 1994)
[n] Values compiled from Tables 10, 18 and 19 from CRITFC 1994. The average consumption rate for Pacific Northwest Salmon was estimated to be 20 grams/day. That was subtracted from the average for all fish for consumers only to result in 43 grams/day as the average fish consumption for adult consumers only for resident fish. The ratio of .73% (all fish/resident) was then applied to the other percentiles. All values are estimates.
[o] The mean values were taken from Table 16 and all other percentiles were estimated from Table 15 in CRITFC 1994. All calculated values are estimates.
[p] The mean values were taken from Table 24 and all other percentiles were estimated from Table 24 in CRITFC 1994. All calculated values are estimates.

[q] All values taken from EPA 2002 Section 5.1.1.1, Table 5
[r] All values taken from EPA 2002 Section 5.2.1.1, Table 5
[s] All values taken from EPA 2002 Section 5.2.1.1, Table 3
[t] All values taken from EPA 2002 Section 5.2.1.1, Table 1
[u] All values calculated using 16.8 as the average body weight of children and applying that body weight to values in Table T-14 in Suquamish 2000
[v] All values were calculated using an average child BW of 15.2 kg (from Table A1) and the consumption rates Toy et al., 1996, Table A9
[v] All values were calculated using an average adult female BW of 76 kg and adult male body weight of 86 kg (from Table A1) and the consumption rates Toy et al., 1996, Table A4
[w] All values taken from Adolphson 1996, Table 4, page 20. Values were converted to grams/day from kg/person/year.
[x] All values taken from Dave McBride's summary of the Lake Whatcom 2001 study. Adult average consumption of 225 g/meal was used along with a median children rate of 131 g/meal. 10 meals were assumed per year
[y] All values taken from Dave McBride's summary of the Lake Roosevelt 1997 study.
[z] All values taken from Dave McBride's summary of the Lake Roosevelt 1997 study. 90g/day was labeled as "high end consumers" and placed in the 99th percentile column for that reason.
[aa] All values taken from Rhodes 2006, Table 32.
[ab] Burger et al 1999; interview of Savannah R fisherman; n=258; mean serving size 376 g; mean fish/month 1.46 kg; mean fish per year 17.6 kg; mean age 43; 48 g/day
[ac] Chan et al 1999 questionnaire of consumption over the past 12 months; n= 42, average age 39 years; 474 to 766 grams per meal
[ad] Dellinger, 2004 questionnaire fish consumption for 12 months; estimated grams per meal = 280 grams, GLIFWC 2003 summarized in Dellinger 2003 147 tribal members from 1999 to 2002

Lake Huron Michigan, Superior	male & female adults (n=271 age 40)
Lake Superior	male & female adults (n= 346; 41 years)
Inland Lakes	male & female adults (n=63; age=40)
Menominee	male & female adults (n=66; age=39)
Other Res	male & female adults (n=76; age=43)
All tribes	male & female adults (n=822; age=41)

[ae] Moss et al 2004, interview of 4 Sencoten villages during summer of 2001; n=76 ages 13-75; individuals selected at random; focused on marine species; estimate monthly or yearly number of meals;
estimate grams per day (1 portion = 180 grams); 36 meals of salmon per year= 10.3 kg per person per year; 86 meals of all marine food per person per year;
Note adults over 40 years consume more fish than youth or young adults (13-40 years)
44 g/day 86 meals x 186 grams/meal divided by 365
28 g/day 10.3 kg x 100 g/kg divided by 365
48 g/day 17.5 kg x 100 g/kg divided by 365
[af] Nagakawa et al 1997 study of mercury in fish; fish rates are mean consumption of eatable fish per capita per day. Methodology for consumption survey was not reported.
1976 data are extracted from Kitamura, s. Kondo, m. Takizawa, t. Fuji, m. Mercury Kodansha Japan 267-273 1976
[ag] Dickman and Leung 1998; study of mercury and PCBs in fish tissue; Hong Kong Asians consume fish 3 to 4 times per week; Hong Kong average person 4 or more times per week average 60 kg per year; Finland and Europe fish consumption is lower; assuming 1/2 of what is imported is consumed = 18.9 kg fresh fish per person or 52 grams per day.
164 g/day60 kg/year extracted from Consumer Asia Euromonitor plc 60-61 Britton St. London ECIM 5NA 1997
52 g/day 234500 tonnes of fish imported 1/2 consumed = 117245 tonnes by 6.2 million people 18.9 kg fresh fish per person or 52 grams per day
[ah] Values computed using a weighted average of body weight for males and females from Table A1, which was calculated as 82kg. Body weight was multiplied by "total fish" values in Table A2 to obtain final values listed.

8. REFERENCES

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10. GLOSSARY OF ACRONYMS AND UNITS OF MEASURE

10.1 ACRONYMS

AWQC	Ambient Water Quality Criteria.
BCF	Bioconcentration factor (generally expressed in liters per kilogram)
BW	Body weight (generally expressed in kilograms)
CRITFC	Columbia River Inter-Tribal Fish Commission, including the Warm Springs, Yakama, Umatilla, and Nez Perce Tribes
CROET	Center for Research on Occupational and Environmental Toxicology (CROET), Oregon Health & Science University
CSFII	Continuing Survey of Food Intakes by Individuals. A survey conducted by the United States Department of Agriculture (USDA) 1994-1996 and 1998
CTUIR	Confederated Tribes of the Umatilla Indian Reservation, including the Cayuse, Umatilla and Walla Walla Tribes
CWA	Clean Water Act.
DABT	Diplomat of the American Board of Toxicology
DEQ	Oregon Department of Environmental Quality
DHS	Oregon Department of Human Services
DI	Drinking water intake (generally expressed in liters per day)
EPA	United States Environmental Protection Agency
EQC	Environmental Quality Commission
FCR Project	Oregon Fish and Shellfish Consumption Rate Project
FCR	Fish Consumption Rate
HHFG	Human Health Focus Group
HQ	Hazard Quotient

NMFS	National Marine Fisheries Service
NPDES	National Pollutant Discharge Elimination System program
OAR	Oregon Administrative Rules
OEHHA	Office of Environmental Health Hazard Assessment; a division of the California Environmental Protection Agency
PAC	Policy Advisory Committee
PCB	Polychlorinated biphenyl
RfD	Reference dose
RSC	Relative Source Contribution
TAC	Technical Advisory Committee
TMDL	Total Maximum Daily Load
URL	Uniform Resource Locator, the global address of documents and other resources on the World Wide Web
USDA	United States Department of Agriculture
WQC	Water quality criteria.
WQS	Water quality standards
WSDOH	Washington State Department of Health.

10.2 UNITS OF MEASURE

g/day	grams per day
g/kg/day	grams per kilogram per day
kg	kilogram
kg/day	kilogram per day
L/day	liter per day
L/kg	liter per kilogram
µg/L	micrograms per liter
mg/kg	milligrams per kilogram
mg/kg/day	milligrams per kilogram per day

APPENDIX A: FISH SPECIES IDENTIFIED AS CONSUMED IN SELECT SURVEYS

APPENDIX A – 1. SPECIES GROUPS LISTED IN A FISH CONSUMPTION SURVEY OF THE UMATILLA, NEZ PERCE, YAKAMA, AND WARM SPRINGS TRIBES OF THE COLUMBIA RIVER BASIN (CRITFC, 1994)

Anadromous	Resident
Salmon	Trout
Steelhead	Whitefish
Lamprey	Sturgeon
Smelt	Walleye
Shad	Squawfish
	Sucker

APPENDIX A – 2. SPECIES GROUPS LISTED IN A FISH CONSUMPTION SURVEY OF THE TULALIP AND SQUAXIN ISLAND TRIBES OF THE PUGET SOUND REGION (TOY ET AL. 1996)

Group A	Group B	Group C	Group D	Group E	Group F
Anadromous	**Pelagic**	**Bottom**	**Shellfish**	**Other**	**Other 2**
Chinook salmon	Cod	Halibut	Clams (Manila/Littleneck)	Canned Tuna	Trout
Pink salmon	Pollock	Sole/Flounder	Horse clam		
Sockeye salmon	Sablefish	Sturgeon	Butter clam		
Coho salmon	Rockfish	Skate	Cockles		
Chum salmon	Greenling	Eel	Mussels		
unidentified salmon	Herring	Grunters	Oysters		
Steelhead	Spiny		Shrimp		
Smelt	Dogfish		Dungeness Crab		
	Perch		Red Rock Crab		
	Mackeral		Moon Snail		
	Shark		Scallops		
			Squid		
			Sea Urchin		
			Sea Cucumber		
			Sea Urchin		
			Geoduck		
			Limpets		
			Lobster		
			Bullhead		
			Manta Ray		
			Razor clam		
			Chitons		
			Octopus		
			Abalone		
			Chitons		
			Barnacles		
			Crayfish		

Fish Consumption Survey of the Suquamish Indian Tribe of the Port Madison Indian Reservation, Puget Sound Region (Suquamish, 2000)

APPENDIX A-3. SPECIES GROUPS LISTED IN FISH CONSUMPTION SURVEY OF THE SUQUAMISH TRIBES OF THE PORT MADISON INDIAN RESERVATION, PUGET SOUND REGION (SUQUAMISH, 2000)						
Group A	**Group B**	**Group C**	**Group D**	**Group E**	**Group F**	**Group G**
King salmon	Smelt	Cod	Halibut	Manila/Littleneck clams	Cabezon	Abalone
Sockeye salmon	Herring	Perch	Sole/Flounder	Horse clams	Blue Back (sockeye)	Lobster
Coho salmon		Pollock	Rockfish	Butter clams	Trout/cutthroat	Octopus
Chum salmon		Sturgeon		Geoduck	Tuna (fresh/canned)	Limpets
Pink salmon		Sable fish		Cockles	Groupers	Miscellaneous
unidentified salmon		Spiny dogfish		Oysters	Sardine	
Steelhead		Greenling		Mussels	Grunter	
Salmon (gatherings)		Bull Cod		Moon snails	Mackerel	
				Shrimp	Shark	
				Dungeness crab		
				Red rock crab		
				Scallops		
				Squid		
				Sea urchin		
				Sea cucumber		
				Oysters (gatherings)		
				Clams (gatherings)		
				Crab (gatherings)		
				Clams (razor, unspecified)		
				Crab (king/snow)		

APPENDIX A-4 SPECIES GROUPS IN ASIAN AND PACIFIC ISLANDER SEAFOOD CONSUMPTION STUDY (SECHENA ET AL. 1999).

Anadromous Fish	%	Pelagic Fish	%	Freshwater Fish	%	Bottom Fish	%	Shellfish	%	Seaweed /Kelp	%
Salmon	93	tuna	86	catfish	58	halibut	65	shrimp	98	seaweed	57
Trout	61	cod	66	tilapia	45	sole/flounder	42	crab	96	kelp	29
Smelt	45	mackerel	62	perch	39	sturgeon	13	squid	82		
Salmon eggs	27	snapper	50	bass	28	suckers	4	oysters	71		
		rockfish	34	carp	22			manila/ littleneck clams	72		
		herring	21	crappie	17			lobster	65		
		dogfish	7					mussel	62		
		snowfish	6					scallops	57		
								butter clams	39		
								geoduck	34		
								cockles	21		
								abalone	15		
								razor clams	16		
								sea cucumber	51		
								sea urchin	14		
								horse clams	13		
								macoma clams	9		
								moonsnail	4		

APPENDIX B: RELATIVE SOURCE CONTRIBUTION FACTOR FOR METHYLMERCURY

Excerpt from EPA Criterion document for Methylmercury Table 5-14, Average Mercury Concentrations in Marine Fish and Shellfish Species (EPA 2001).

Species	Concentration [a] (µg Hg/g Wet Wt.)	Species	Concentration [a] (µg Hg/g Wet Wt.)
Finfish			
Anchovy	0.047	Pompano*	0.104
Barracuda, Pacific	0.177	Porgy*	0.522[b]
Cod*	0.121	Ray	0.176
Croaker, Atlantic	0.125	***Salmon****	***0.035***
Eel, American	0.213	Sardines*	0.1
Flounder*,[e]	0.092	Sea Bass*	0.135
Haddock*	0.089	Shark*	1.327
Hake	0.145	Skate	0.176
Halibut*	0.25	Smelt, Rainbow*	0.1
Herring	0.013	Snapper*	0.25
Kingfish	0.10	Sturgeon	0.235
Mackerel*	0.081	Swordfish*	0.95[c]
Mullet	0.009	Tuna*	0.206
Ocean Perch*	0.116	Whiting (silver hake)*	0.041
Pollock*	0.15	Whitefish*	0.054[d]
Shellfish			
Abalone	0.016	Oysters	0.023
Clam*	0.023	Scallop*	0.042
Crab*	0.117	Shrimp	0.047
Lobster*	0.232	Other shellfish*	0.012b
Molluscan Cephalopods			
Octopus*	0.029	Squid*	0.026

Source: U.S. EPA (1997c).
*Denotes species used in calculation of methylmercury intake from marine fish for one or more populations of concern, based on existence of data for consumption in the CSFII (U.S. EPA, 2000b).
[a] Mercury concentrations are from NMFS (1978) as reported in U.S. EPA (1997d) unless otherwise noted, measured as ug of total mercury per gram wet weight of fish tissue.
[b] Mercury concentration data are from Stern et al. (1996) as cited in U.S. EPA (1997c).
[c] Mercury concentration data are from U.S. FDA Compliance Testing as cited in U.S. EPA (1997c).
[d] Mercury concentration data are from U.S. FDA (1978) as cited in U.S. EPA (1997c).
[e] Mercury data for flounder were used as an estimate of mercury concentration in marine flatfish in marine intake calculations.

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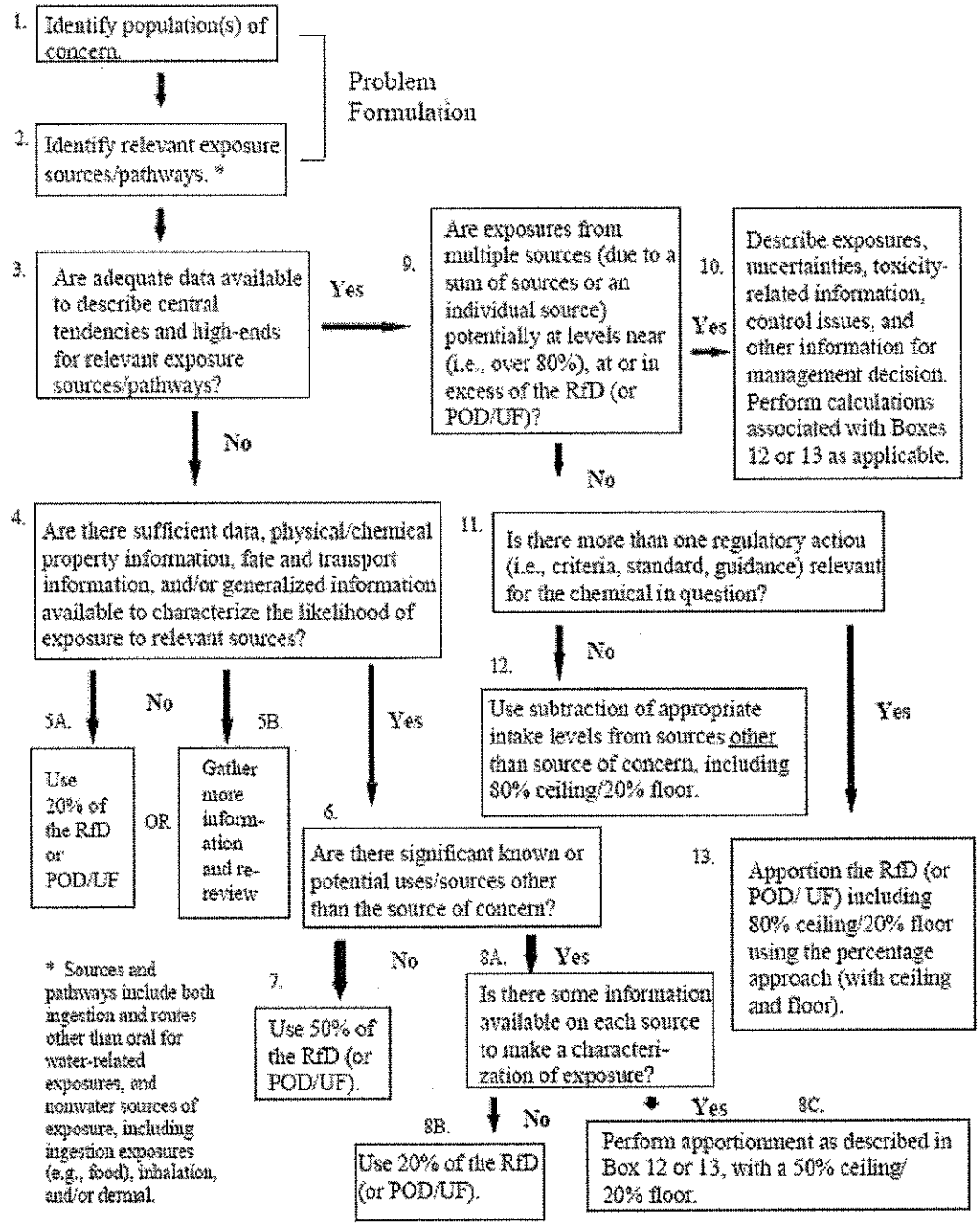
APPENDIX C: BASIS FOR RELATIVE SOURCE CONTRIBUTION VARIABLES

Compound	EPA's Recommended RSC[1, 2]	Sources of Exposure	Citation
Antimony	40%	Drinking Water Contribution= 40% Diet Contribution=50%, Inhalation Contribution=10%	Drinking Water: National Primary Drinking Water Regulations (7/17/1992) 57 FR 31784
Methylmercury	2.7×10^{-5} mg/kg BW/day (subtracted from RfD)	Accounts for marine fish consumption	EPA Methylmercury Criterion Document (1/2001) EPA 823-R-01-001
Thallium	20%		
Cyanide	20%	Available data on dietary exposure are inadequate, so apply the default value of 20% RSC.	Drinking Water: National Primary Drinking Water Regulations (7/17/1992) 57 FR 31784
Chlorobenzene	20%		
1,1 Dichloroethylene	20%	Detected in several sources (i.e. air, and wells contaminated with other solvents).	EPA Health Advisory for 1,1-Dichloroethylene of Office of Drinking Water (3/31/1987)
Ethylbenzene	20%	Primary source of exposure is from the air, although contaminants in drinking water can be quite high for wells near leaking gasoline storage tanks and drinking waters taken from surface waters.	Technical Fact Sheet on Ethylbenzene for the National Primary Drinking Water Regulations. http://www.epa.gov/safewater/dwh/t-voc/ethylben.html
Toluene	20%	Based on available data, the major source of toluene exposure is from air; occurs in low levels in drinking water, food and air. Where actual exposure data are not available, 20% RSC is assumed.	EPA Health Advisory for Toluene of Office of Drinking Water (3/31/1987)
1,2 Transdichloroethylene	20%		
1,2 Dichlorobenzene	20%	Detected in multiple sources (i.e. ground water, surface water, air), however there are insufficient data to determine where the major route of environmental exposure.	EPA Health Advisory for Ortho-, Meta-, and Para-Dichlorobenzenes of Office of Drinking Water (3/31/1987)

Compound	EPA's Recommended RSC[1, 2]	Sources of Exposure	Citation
1,4 Dichlorobenzene	20%	Detected in multiple sources (i.e. ground water, surface water, air), however there are insufficient data to determine where the major route of environmental exposure.	EPA Health Advisory for Ortho-, Meta-, and Para-Dichlorobenzenes of Office of Drinking Water (3/31/1987)
Heachlorocyclo-pentadiene	20%		
1,2,4 Trichlorobenzene	20%		
Gamma BHC	20%		
Endrin	20%	Human exposure appears to most come from food or an occupational source. Monitoring data demonstrates it continues to be a contaminant from air, water, sediment, soil, fish, and other aquatic organisms.	Technical Fact Sheet on Endrin for the National Primary Drinking Water Regulations. http://www.epa.gov/safewater/dwh/t-soc/endrin.html

[1] EPA, 2002. National Recommended Water Quality Criteria: 2002 Human Health Criteria Calculation Matrix. EPA-822-R-02-012.
[2] EPA, 2003. National Recommended Water Quality Criteria for the protection of Human Health. 68 FR 75507-75515.

APPENDIX D: EPA's DECISION TREE FOR DEVELOPING A RELATIVE SOURCE CONTRIBUTION [2]



[2] EPA, 2000. Methodology for Deriving Ambient Water Quality Criteria for the Protection of Human Health. EPA 822-B-00-0004. P. 4-8.

Fiscal Impact and Implementation Advisory Committee
Membership

Member:	**Organization**
Sarah Kruse (Co-Chair)	Eco Trust
Kristen Lee (Co-Chair)	ECO Northwest
Deanna Connors	Oregon Dept. of Health Services
Kathleen Feehan	Confederated Tribes of the Umatilla Indian Reservation
Rich Garber	Boise Cascade
Eric Scott	Grande Ronde Tribe
Susie Smith	Oregon Assn. of Clean Water Agencies
Willie Tiffany	League of Oregon Cities
Kathryn VanNatta	Northwest Pulp and Paper Association

Oregon Fish and Shellfish Consumption Rate Project
Fiscal Impact and Implementation Advisory Committee
Proposed Charter-Revised - March 5, 2008

The Oregon Fish and Shellfish Consumption Rate Project, a joint project of DEQ, U.S. EPA and the Confederated Tribes of the Umatilla Indian Reservation (CTUIR), is evaluating options to revise Oregon's fish consumption rate, which is one variable used to calculate water quality criteria protective of human health. This effort is anticipated to end in late 2008 when the Environmental Quality Commission (EQC) chooses a fish consumption rate for rulemaking.

By October 2008, DEQ, EPA, and CTUIR plan to present a report to the EQC with a range of options to revise the fish consumption rate, with a goal of one joint recommendation from those options. The report will include a range of proposed implementation options

In order to develop feasible implementation options, the cost of each option will need to be understood. DEQ, EPA and CTUIR are convening the Fiscal Impact and Implementation Advisory Committee (FIIAC) as a group of interested experts who can help to develop feasible implementation options and provide input on the fiscal impacts such options may have on a wide range of interest groups throughout the state. It is anticipated that this group will also serve as DEQ's Fiscal Impact Advisory Committee under Oregon Revised Statute 183.333.

DEQ is working with EPA Headquarters, through an EPA contractor, Science Applications International Corporation (SAIC), to develop and perform a Fiscal Impact Analysis on the impacts of raising Oregon's fish consumption rate (FCR). An increase in the FCR will affect human health water quality criteria. The Fiscal Impact Analysis will be used to develop DEQ's Statement of Need and Fiscal and Economic Impact for the formal rulemaking to change the human health criteria.

DEQ does not have the time or funding to research and do a credible quantitative analysis of the direct and indirect economic benefits of increased fish consumption rates. However, members of the FIIAC will be able to provide information about the effects, both positive and negative, of an increased fish consumption rate. Members of the Committee can also share ideas for how DEQ can best reflect economic benefits within the time and fiscal constraints of this process.

The members of the Fish and Shellfish Consumption Rate Project's Fiscal Impact and Implementation Advisory Committee agree to operate under this Charter.

I. Committee Charge

The FIIAC will be charged with the following tasks:

1) Consider and possibly contribute to the Implementation Strategies Inventory that will be compiled by DEQ and used in developing implementation options for potential new human health criteria.

2) Review and comment on the Draft Fiscal Impact Analysis in accordance with ORS 183.333. The analysis will be used to develop DEQ's Statement of Need and Fiscal and Economic Impact in anticipation of a future rulemaking to raise the FCR and lower human health water quality criteria. The FIIAC will address the following questions in their review:

   i) Would increasing the FCR have a fiscal and economic impact?
   ii) What is the extent of that fiscal and economic impact?
   iii) Would increasing the FCR have a significant adverse impact on small businesses?
   iv) What is the extent of that fiscal and economic impact to small businesses?

   In addition, it is anticipated that members of this Committee will be able to provide information about the economic benefits of an increased fish consumption rate; information about economic or other benefits of an increased fish consumption rate will be provided to the EQC to help inform their final decision.

3) Discuss implementation options for multiple fish consumption rate scenarios

4) Provide any recommendations on fiscal impact and implementation strategies

II. Meeting Schedule and Guidelines

Meeting Schedule

FIIAC meetings will likely be all-day meetings (10:00 – 4:00).

1) Meeting #1: January 29, 2008, Portland.
   i) The purpose of this meeting is to discuss and for DEQ to receive comments on any oversights in the Fiscal Impact Analysis' scope of work.
   ii) The Implementation Strategy Inventory will be introduced, explained and contributions will be requested for consideration in the analysis.
2) Meeting #2: March 5, Portland.
   i) The purpose of this meeting is to discuss and receive comments on the results of the Fiscal Impact Analysis. The FIIAC will comment and make recommendations on the adequacy of the work completed. The FIIAC will also discuss implementation issues associated with the various options presented in the fiscal impact analysis.
3) Meeting #3: April 8, Portland
   i) Follow up on Fiscal Impact Analysis, additional scope of EPA information gathering to support the FIIAC
   ii) Continue discussion of implementation, benefits.
4) Meeting #4: May, Portland
   i) Continuation of discussion of implementation strategies.
5) Meeting #5: Fall 2008 or winter 2009 (if necessary)
   i) The FIIAC may re-convene prior to the formal rulemaking process if additional economic analysis and review is necessary.

FIIAC Meeting Guidelines

1. Participation in the FIIAC is voluntary
2. Meetings will be facilitated to ensure that the group completes the specific charges outlined in the Charter as adopted by the Committee
3. DS Consulting will facilitate all meetings
4. Members will attend each meeting to ensure continuity throughout the process;
5. Members will be prepared for meetings by reviewing all materials in a timely manner and consulting with their constituents as needed;
6. Members will treat others and his or her opinions with respect;
7. All members will listen to each other to seek to understand the others' perspectives. Each will be given an opportunity to speak and be heard;
8. Members will engage in honest, constructive, and good faith discussions in all aspects of the discussion;
9. Members will consult regularly with their constituencies and provide their input to the committee in a timely manner; and
10. Members will not represent the view of any other member, group, or the Committee as a whole in any forum outside of the meetings.

The FIIAC will seek consensus recommendations on all issues identified. Consensus is defined as the willingness to actively support any decision to move forward. However, if the committee cannot achieve consensus on an issue within a reasonable amount of time, then the final report will note the different perspectives on the issue.

Meeting Materials and Summaries

FIIAC members will be provided at least 1 week of review time for all documents, and we will strive to provide 2 weeks when possible. DS Consulting will prepare FIIAC meeting notes. Meeting notes will summarize significant issues raised during the discussion. Any FIIAC recommendations will also be captured in the notes. The meeting summaries will be posted to the DEQ website once they have been reviewed and approved by FIIAC members. Members will have 48 hours to comment on the notes after they have been received, after which time the notes will be posted and can be shared with others.

Chairperson

Members of the FIIAC may elect a Chairperson from amongst themselves. If requested, DEQ, EPA and CTUIR would also consider identifying a Chairperson from among candidates suggested by FIIAC members. The Chairperson has the responsibility to:

- Work with committee members to finalize a memo that summaries the committee's agreements, disagreements and consensus recommendations;
- Work closely with the facilitator (DS Consulting) to help the group work effectively together; and
- Represent or delegate representation of the FIIAC in any public forums (such as EQC meetings).

III. Final Product

The FIIAC's discussions and recommendations will be summarized by DS Consulting in a memo. All meeting notes may be attached to the memo. The memo will not be finalized until the Chairperson has coordinated all comments of the FIIAC members and the group agrees, by consensus, that the memo is final. Should the committee not be able to finalize the memo based on consensus without undue delay, the project may need to continue to move forward before the memo is finalized.

State of Oregon
Department of Environmental Quality

Cost of Compliance: SAIC Report

Jennifer Wigal
Oregon DEQ

Workshop: Fiscal Impact and Implementation Strategies of a Revised Fish Consumption Rate
June 27, 2008

State of Oregon
Department of
Environmental
Quality

Overview

- Analysis conducted by EPA-funded contractor, SAIC
- Charged with estimating the incremental cost of compliance to meet revised water quality criteria based on a new fish consumption rate
- Analysis contains
  - Estimates of costs for point sources
  - Qualitative description of potential costs for nonpoint sources and stormwater
  - Estimates of government regulatory costs associated with variances and an increase in the number of impaired waters
  - Discussion of uncertainties and limitations
  - Approaches and results of implementation activities and relevant actions in other states

State of Oregon
Department of
Environmental
Quality

Approach to Estimating Costs

- Selection of facilities
  - Reviewed 1 minor steel mill and 4 largest facilities (municipalities, one of which is dominated by industrial wastewater)
  - Representative random sample of 15 additional facilities (both municipal and industrial)
- Cost estimated between "baseline" and revised criteria based on a range of fish consumption rates
  - Baseline considered to be water quality criteria currently in effect

State of Oregon
Department of Environmental Quality

Methodology

- Followed DEQ's current Internal Management Directives where applicable
- Used data contained in EPA and DEQ data systems; additional data provided by DEQ
- Assumptions
  - Facilities with higher flows are most likely to incur the greatest costs
  - Facilities would pursue least cost approach to compliance, which would include consideration of the following:
    - Optimizing treatment processes
    - Source control
    - Installing end-of-pipe treatment
    - Alternative compliance mechanisms (e.g., variance)
  - Facility compliance determined at the method quantification level (i.e., level at which laboratory method can quantify pollutant levels present in the sample)

State of Oregon
Department of
Environmental
Quality

Point Sources—Which Pollutants Are Likely to Have an Effect?

- Reductions in effluent concentrations needed for at least 6 pollutants to achieve baseline water quality criteria:
  - 4,4'-DDT, alpha BHC, arsenic, bis(2-ethylhexyl) phthalate, dioxin, mercury
- Additional reduction efforts under revised criteria would also likely be needed for 3 of those pollutants:
  - Arsenic, bis(2-ethylhexyl) phthalate, mercury
- Limitations
  - Small sample of facilities
  - List based on currently available data. Additional ambient and effluent data may result in different conclusions.

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Point Sources—Approaches to Compliance

- Report concluded that sources would likely employ several compliance approaches to meet revised water quality criteria
- Depending on the criterion, approaches would include:
  - Some treatment
  - Pollution prevention programs
  - Inflow and Infiltration controls (relevant for Arsenic)
  - Variances
  - Intake credits

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Point Sources—Estimated Annual Costs

- Baseline
  - $3.62 to $3.92 million (not including inflow & infiltration costs)
  - $3.62 to $29.7 million (includes I&I)
- Revised Criteria
  - $75,000 to $1.82 million,
    - Low end -- costs attributable to 63.2 gpd FCR, no I&I
    - High end – costs attributable to 389 gpd, including I&I
  - Facility actions to comply with baseline also results in compliance with the revised standards
  - Majority of the costs attributable to meeting baseline standards

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Nonpoint Sources and Stormwater—Which Pollutants Are Likely to Have an Effect?

- Pollutants where point source controls insufficient to meet revised criteria
  - Could include arsenic, bis(2-ethylhexyl) phthalate, mercury
- Pollutants where ambient concentrations exceed criteria
  - Existing data indicate antimony, beta-BHC, and mercury could be included

- Potential sources include
  - agricultural and forest lands,
  - storm water,
  - legacy mining,
  - atmospheric deposition,
  - natural sources and
  - municipal and industrial point sources

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Nonpoint Sources and Stormwater—Potential Costs

- Costs highly uncertain
  - Controls largely based on BMPs, which are not designed to achieve a specific percent reduction in pollutants
  - Report qualitatively concludes that costs could be significant due to ubiquitous pollutants

- Report includes information regarding potential controls and associated unit costs, where available

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Government Regulatory Costs

- Report estimates government regulatory costs associated with
  - Additional waters listed as impaired and subsequent TMDL development
    - Estimated to be $26,000 to $500,000 per TMDL
  - Processing applications for variances
    - Estimated one-time incremental cost of $65,000 under existing regulations
  - Other government costs outside the scope of work

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Uncertainties in the Analysis

- Data limitations
  - Effluent data
  - Ambient data
  - Controls and activities underway
- Potential pollutant load reductions achievable
  - Method quantitation limits
- Dischargers' response to potential revised requirements and permit conditions

COST OF COMPLIANCE WITH WATER QUALITY CRITERIA FOR TOXIC POLLUTANTS FOR OREGON WATERS

EXECUTIVE SUMMARY

June 2008

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Executive Summary

The Oregon Department of Environmental Quality (ODEQ) is considering revising the fish consumption rate for calculating water quality criteria applicable to waters in the state. This report provides estimates of the potential incremental compliance actions and costs that may be associated with such a change to the state's water quality standards (WQS).

ES.1 Background

In May 2004, the Oregon Environmental Quality Commission (EQC) adopted revisions to Oregon Administrative Rules (OAR) covering water quality criteria for toxics (OAR 340-041 - 0033). The EQC revised the representative fish consumption rate for deriving human health criteria from 6.5 grams per day (gpd) to 17.5 gpd based on EPA (2000a) guidance. On July 8, 2004, ODEQ submitted the revised toxics criteria to EPA Region 10 for review and approval. The more stringent criteria took effect on February 15, 2005 before EPA Region 10 approval (those criteria that are less stringent than the existing criteria cannot be implemented without EPA approval). However, the Confederated Tribes of the Umatilla Indian Reservation (CTUIR) and other tribes objected to the revised criteria on the basis that the fish consumption rate does not account for higher fish consuming populations, which include Tribal members. As a result, ODEQ is considering adopting a more protective fish consumption rate for calculating revised human health criteria.

ES.2 Scope of Analysis

The purpose of this analysis is to identify, using available water quality and discharge data and information, the potential incremental compliance actions and costs that publicly owned wastewater treatment works (POTWs) and industrial point source dischargers may incur as a result of potential revised criteria. These impacts may occur as a result of changes to the National Pollutant Discharge Elimination System (NPDES) permits for these facilities to incorporate revised water quality based effluent limits (WQBELs). Because ODEQ has yet to implement WQBELs reflecting existing criteria for toxic pollutants, we also identify the level of controls and costs that would be needed in the absence of any revisions to the fish consumption rate. Due to time and resource constraints, including the large number of pollutants of concern and limited monitoring data, the estimates of statewide compliance costs reflect the extrapolation of results for a small sample of dischargers.

Although the focus of this analysis is compliance costs for wastewater point sources, the revised standards may also result in a need for incremental controls by municipal storm water and nonpoint sources discharging to surface waters. However, the data and information needed to evaluate potential control needs is more limited. Thus, we identify the types of controls and costs that may be incurred for these sources but do not develop statewide cost estimates.

For changes to water quality criteria within an existing water quality standards and NPDES permitting program, compliance costs likely represent the major component of total potential

social costs. There may be some incremental regulatory program costs under the higher fish consumption rates associated with an increased number of impaired waters and TMDL development. However, for the most part, data are not sufficient to estimate these government costs.

Social costs will be accompanied by the social benefits resulting from the control actions. Similarly, adverse economic impacts (municipal and industrial expenditures financed through user fees and profits) will be accompanied by increased employment, incomes, revenues, and profits to sectors supplying compliance technologies and services (which may be within or external to Oregon). The scope of this analysis is limited to an evaluation of potential compliance costs; this report does not provide estimates of potential benefits of revised standards or an economic impact analysis.

ES.3 Baseline for the Analysis

OAR 340-041-0033, Table 33A and Table 20 provide existing water quality criteria for the protection of human health based on consumption of water and organisms (e.g., fish) and organisms only. ODEQ established the criteria in Table 33A in 2004 based on EPA's recommended national fish consumption rate of 17.5 gpd. Only those criteria in Table 33A more stringent than the previous criteria in Table 20 are applicable; those less stringent are not to be implemented in NPDES permits until ODEQ receives EPA approval.

Toxic pollutants can be introduced to surface water through point sources (e.g., municipal and industrial effluents), storm water discharges, and nonpoint sources (e.g., agricultural runoff, forestry, mines, and atmospheric deposition). Point source and storm water discharges are regulated under the NPDES permit program. However, in Oregon, these permits do not currently include WQBELs reflecting the baseline human health criteria. Nonpoint sources are primarily controlled through various management plans and policies and TMDL load allocations, although these baseline requirements to attain existing criteria (including TMDLs for nontoxic pollutants that could result in reduced levels of toxics) have not been fully implemented. Thus, even in the absence of revised fish consumption rates for calculating human health criteria, some dischargers will need to take actions to comply with existing criteria.

ES.4 Potential Revised Criteria

ODEQ is considering several revised fish consumption rates for calculating human health criteria, including 63.2 gpd, 113 gpd, 175 gpd, 389 gpd, and 620 gpd. For most pollutants, revising the fish consumption rate would result in criteria more stringent than the existing baseline criteria (exceptions include nickel, benzene, and chloroform, among others). For some pollutants, the change in fish consumption rate will not have an incremental impact on projected effluent limits compared to baseline criteria because both baseline and revised criteria are below applicable quantification limits (QLs; the levels to which dischargers have to reduce effluent concentrations). Nevertheless, there are 91 pollutants with baseline and revised human health criteria more stringent than the existing aquatic life criteria.

ES.5 Method for Evaluating Effect on Point Sources

Compliance costs for municipal and industrial point sources may result from changes to NPDES permit requirements. To evaluate the potential effect of the potential revised criteria on NPDES permit conditions and compliance actions for wastewater point sources, we evaluated available effluent and ambient data for a sample of facilities. We first evaluated compliance with baseline criteria by conducting a reasonable potential analysis (RPA), estimating load reductions, and determining controls (or alternative compliance measures) and costs needed for compliance. Then, we evaluated the incremental reductions that would be needed under the revised criteria, and estimated incremental compliance actions and costs.

ODEQ (2005) procedures provide permit writers instructions for determining whether dischargers have RP to cause or contribute to an exceedance of WQS, and how to calculate effluent limits for those pollutants with RP. We used these procedures in determining RP and effluent limits under the baseline as well as the revised criteria, although there is uncertainty regarding implementation procedures that may accompany a revised fish consumption rate. For mercury, we used EPA procedures and default values for translating the fish tissue criterion into a water column number for implementation into permits (U.S. EPA, 2001).

To identify potential compliance actions, we evaluated likely sources of the pollutants in the effluent and the effectiveness of different methods to reduce effluent concentrations. Analysis of the available data for a small sample of facilities indicates that there are likely to be exceedances of projected effluent limits for 4,4'-DDT, alpha-BHC, arsenic, bis(2-ethylhexyl) phthalate, dioxin, and mercury. There are a number of potential alternatives for compliance with effluent limits for these pollutants, including:

- Optimizing treatment processes (e.g., adding chemicals to increase flocculation or filtration efficiency) to increase pollutant removal efficiencies
- Source control (e.g., pollution prevention program, inflow and infiltration reductions, more stringent pretreatment standards)
- Installing end-of-pipe treatment technology (e.g., reverse osmosis, granular activated carbon, or chemical precipitation)
- Alternative compliance mechanisms (e.g., site-specific criterion, TMDL, or variance).

Dischargers will pursue the lowest cost means of compliance with effluent limits. However, for the potential revised criteria, technical feasibility is also an issue. For many pollutants, the lowest levels achievable through end-of-pipe treatment are highly uncertain due to the fact that no other dischargers have been required to treat to such low levels and performance data are not available. Thus, due to the uncertainty of achievable effluent levels, we did not identify any end-of-pipe treatment technologies capable of producing the necessary effluent concentrations on a consistent and reliable basis. In addition, even for technologies that could in theory result in compliance, other factors such as disposal of residual streams and very high costs per pound of pollutant removed may render such solutions infeasible, especially at municipal facilities. Hence, there may be a need for alternative compliance mechanisms.

For example, mercury and arsenic are the two main pollutants of concern for the sample facilities we evaluated. There are currently no proven end-of-pipe treatment technologies that can achieve

low mercury levels (e.g., <10 ng/L) on a consistent basis. Pollution prevention (P2) or source control is a cost-effective means of reducing mercury in wastewater effluents. However, there could be some maximum level of effort beyond which a P2 program would not provide additional reductions and a discharger may need to pursue alternative compliance mechanisms such as a variance.

For arsenic, we estimated a range of actions and costs that included intake credits, best management practices, inflow and infiltration (I&I) reduction programs, and variances. Since the source in municipal wastewater may be from contaminated groundwater leaking into the sewer system, I&I controls might enable compliance with baseline and revised criteria. We estimated the potential cost of such actions based on unit costs from a consulting firm specializing in I&I reduction programs. However, such a scenario may be unlikely for compliance with WQBELs for arsenic alone due to the fact that I&I reduction may be needed for other reasons (reduce flow to treatment plant, which reduces treatment costs, and to reduce sewer overflows). Indeed, state infrastructure needs include I&I reduction at a number of municipal systems (OECDC, 2007).

Thus, due to the uncertainties associated with estimating compliance actions and costs, we included a range of costs based on the most likely compliance scenarios.

ES.6 Method for Evaluating Effect on Nonpoint Sources

Unlike point sources, ODEQ typically does not require nonpoint sources and municipal storm water dischargers to achieve numeric WQBELs for human health pollutants. The regulatory baseline for evaluating the potential impact of the revised criteria includes some requirements for nonpoint sources and storm water dischargers to implement BMPs and load allocations as part of TMDLs. ODEQ has developed TMDLs for a number of toxic pollutants already and will be developing TMDLs for others. However, the pollutant loading reductions and discharge concentrations that will be achieved through baseline BMPs is uncertain. Thus, there is also uncertainty in the extent of incremental controls that could be required under the potential revised criteria.

Instream monitoring data can be used to assess the impact that a change in the fish consumption rate may have on attainment of water quality criteria and thus, control of potential nonpoint sources. Although not representative of all surface waters, ODEQ's Laboratory Analytical Storage and Retrieval (LASAR) database contains water quality monitoring data for the pollutants of concern. LASAR contains 3,889 water column and 676 fish tissue observations (for mercury) collected between 1997 and 2007 from locations other than point source outfalls for which there is either a reported value or detection limit.

The LASAR data indicate that most of the pollutants with detected values have concentrations that exceed the baseline criteria (the exception is nickel, for which potential revised criteria are less stringent than baseline criteria). Thus, source controls are necessary in the absence of revisions to the fish consumption rate. For antimony, beta-BHC, and mercury, the percent of the data that exceeds the criteria increases with increasing consumption rates (e.g., by a factor of 3 for antimony between baseline criteria and criteria based on the highest consumption rate). In

addition, there may be other pollutants exceeding baseline and revised water quality standards for which detection levels are too high or data are unavailable. Nonpoint sources and storm water may be at least partially responsible for these potential impairments.

ES.7 Results

Costs for compliance with baseline criteria include costs associated with implementation of existing permit limits, plans, and policies that reflect existing criteria. Incremental costs associated with compliance with the potential revised criteria represent the costs of any actions or controls above and beyond those needed to meet baseline requirements.

Point Source Costs

Exhibit ES-1 provides a summary of the potential total and incremental (i.e., above and beyond those needed for compliance with baseline standards) annual statewide costs, both with and without the costs for I&I controls to reduce arsenic in municipal sewer systems. In addition, one-time expenditures associated with variance applications could range from $1.43 million to $7.05 million under the baseline; incremental variance-related expenditures could range from $0.59 million to $2.68 million under revised criteria.

Exhibit ES-1. Summary of Potential Annual Compliance Costs (millions of $2007)

Scenario	Total		Incremental[1]	
	With I&I Costs[2]	No I&I Costs	With I&I Costs[2]	No I&I Costs
Baseline	$3.62 - $29.7	$3.62 - $3.92	NA	NA
63.2 gpd	$3.69 - $29.8	$3.69 - $4.04	$0.075 - $0.13	$0.075 - $0.13
113 gpd	$3.96 - $30.1	$3.96 - $4.31	$0.35 - $0.40	$0.35 - $0.40
175 gpd	$3.96 - $31.0	$3.96 - $4.36	$0.35 - $1.32	$0.35 - $0.45
389 gpd	$4.46 - $31.6	$4.46 - $4.86	$0.85 - $1.82	$0.85 - $0.95
620 gpd	$4.46 - $31.6	$4.46 - $4.86	$0.85 - $1.82	$0.85 - $0.95

NA = Not applicable
1. Represents the difference between total annual cost and baseline costs (i.e., incremental costs above and beyond those needed for compliance with baseline criteria).
2. High estimate includes cost of I&I to reduce arsenic in municipal sewer systems.

The costs for minor dischargers are highly uncertain because there is a lack of data to evaluate effluent quality. For municipal minors, ODEQ (2005) indicates that only domestic sources with a dry weather design flow greater than 1 mgd must sample for toxic pollutants. Thus, unless this requirement changes, it is unlikely that minor municipal dischargers would incur costs for compliance with the baseline or revised criteria. For minor industrial dischargers, ODEQ (2005) indicates that industrial dischargers subject to effluent limitation guidelines would be required to monitor for toxic pollutants. However, effluent toxics data from one of the sample facilities (Oregon Steel Mills) indicates that most toxics are not likely to be present at levels of concern, and those that may be (e.g., arsenic) may not contribute significantly to receiving water concentrations, resulting in BMP requirements rather than numeric WQBELs. Thus, costs to minor industrial facilities for compliance with baseline or revised criteria could be minimal depending on state implementation procedures.

Nonetheless, one potential pollutant of concern for minor municipal dischargers is mercury. Under the 620 gpd alternative fish consumption rate, the revised mercury criterion could be below the detection level of 0.005 µg/L. Due to its ubiquitous nature in the environment (e.g., mercury is found in many household products and can be excreted in human waste because of mercury in dental fillings), it may be unlikely that any municipal discharger would be able to consistently achieve nondetect effluent levels without implementation of controls. Thus, if ODEQ were to require monitoring by minor municipals under such a scenario, these facilities might need to implement P2 for compliance. Annual P2 costs might range from 10% to 50% of the P2 cost for small major facilities, with the range reflecting the potential for piggybacking on the efforts of other nearby facilities. Thus, total annual costs for all 157 minor municipal dischargers for compliance with mercury criteria based on consumption of 620 gpd of fish could range from $0.8 million to $3.9 million. This may be a conservative estimate given the current lack of monitoring requirements for toxic pollutants for municipal dischargers less than 1 mgd.

Indirect dischargers to municipal wastewater treatment plants could also incur costs associated with the baseline and revised criteria if the municipality imposes more stringent pretreatment standards or requirements on these dischargers in an effort to reduce effluent loads. However, indirect dischargers of pollutants for which a municipal wastewater treatment plant would not have RP or need to reduce effluent loads would not be affected. To account for these potential costs, we estimated costs to indirect dischargers to municipal wastewater treatment plants under a mercury P2 program (discussed in Appendix B). For other pollutants, identifying groups of indirect dischargers likely to be contributing to the influent load at the treatment plant is more difficult because the pollutants are no longer actively used (e.g., legacy pesticides), could be formed as a byproduct of numerous processes (e.g., dioxin), or there is a lack of site-specific information available for each discharger to identify where the pollutant is originating [e.g., arsenic, bis(2-ethylhexyl) phthalate]. Thus, it is not possible to estimate pretreatment or P2 costs to indirect dischargers for pollutants other than mercury without specific information on the types of industrial dischargers in each service area.

Nonpoint Source and Storm Water Costs

Under the baseline, control costs for nonpoint sources (e.g., agricultural and forest operations; contamination from historic mining sites) and municipal storm water include those needed to reduce instream pollutant levels to baseline criteria or TMDL targets. Existing regulatory programs have not been fully implemented, and the extent of implementation efforts is uncertain. Thus, the additional controls needed for compliance under the baseline cannot be estimated. There are, however, indications that baseline compliance costs for nonpoint sources and storm water discharges could be substantial. For example, given the impairment status of waters throughout the state for mercury based on existing data and the fact that point source dischargers are not likely to be significant sources of mercury to those waters, it is possible that nonpoint source controls are needed to improve water quality to meet baseline criteria.

There could also be incremental costs to nonpoint and storm water sources associated with meeting new or revised load allocations. However, because baseline programs have not yet been fully implemented, it is uncertain whether some incremental level of control would be necessary for compliance with the revised criteria. For any situation in which controls beyond those required under the baseline are necessary, controls could include:

- Agricultural and forest lands – sediment and erosion controls beyond those specified under existing state and federal regulations and plans
- Mining – cleanup and remediation including excavation and onsite capping of contaminated soils, capping of onsite solid waste mining debris, regrading of tailings to mitigate mass wasting and off-site migration, and abatement and mitigation of physical hazards
- Storm water discharges – increased or additional nonstructural BMPs (e.g., institutional, education, or pollution prevention practices designed to limit generation of runoff or reduce the pollutants load of runoff); and structural controls (e.g., engineered and constructed systems designed to provide water quantity or quality control).

Government Regulatory Costs

Identifying the full scope of regulatory program costs associated with implementing existing criteria and programs is outside the scope of this analysis. There is also substantial uncertainty associated with identifying any incremental impact of revised criteria, since the baseline is not fully implemented. Finally, there is uncertainty regarding the attribution of regulatory program expenditures to criteria revisions. However, as the fish consumption rate increases, the applicable human health criteria decrease, which could result in more stringent and infeasible permit limits for point sources, and incremental impairments and need for TMDL development under the revised criteria.

If dischargers pursue variances for compliance with permit limits for mercury, arsenic, bis(2-ethylhexyl) phthalate, DDT, alpha-BHC, and dioxin, ODEQ costs associated with application review may range from $159,000 under the baseline to $65,000 under the revised criteria. For the most part, data are too limited to identify incremental impairments. For one pollutant, mercury, available ambient monitoring data indicate a potential increase of 9 TMDLs at a consumption rate of 63.2 gpd and 21 TMDLs at a consumption rate of 620 gpd. If, for example, TMDL development costs range from approximately $26,000 to $500,000 (EPA, 2001b), this implies an increased level of expenditure of between $0.23 million and $4.5 million for mercury at a consumption rate of 63.2 gpd, and $0.55 million to $10.5 million for mercury at a consumption rate of 620 gpd. Note that the variance application review and TMDL development costs would not be incurred in any single year; rather, the cost would be spread out over several years (e.g., 5 or 10 year time period).

ES.8 Uncertainties in the Analysis

There are a number of uncertainties in the analysis associated with data limitations, potential pollutant load reductions achievable, and how dischargers would respond to potential revised requirements and permit conditions that affect the estimated costs.

The lack of available data for both point and nonpoint sources adds uncertainties to the analysis of potential costs associated with compliance with the revised criteria, including:

- Data are not available for all pollutants or are extremely limited for some of the sample facilities making it difficult to determine whether the facility is in compliance with baseline standards and whether incremental controls would be needed for compliance with revised criteria. Thus, costs could be higher or lower than shown.

- Lack of effluent flow data from which to calculate appropriate human health dilution factors which could result in lower dilution ratios than actually available, and thus, potentially higher costs.
- In estimating baseline control costs, facility permits and evaluation reports do not provide detailed information on the extent of controls and activities already underway. Thus, baseline costs could be overestimated because facilities may already be implementing controls to address issues such as I&I and P2 programs.
- Lack of available instream monitoring data prevents the estimation of potential statewide costs associated with reductions in pollutant loads from nonpoint sources.
- Lack of data regarding pollutant reductions that have already been or are being achieved with the implementation of BMPs to address existing impairments for conventional pollutants such as temperature and dissolved oxygen. Attainment of standards for these types of pollutants could also result in attainment of the baseline and revised criteria for toxic pollutants, negating the need for additional controls on nonpoint sources.

There is also uncertainty regarding the pollutant loading reductions that would result from compliance with baseline and revised criteria. As the criteria become more stringent under increasing consumption rates, the feasibility of compliance with revised effluent limitations may decrease for some pollutants (e.g., mercury) that are ubiquitous in the environment and for which end-of-pipe treatment to very low levels is unproven. If compliance is not feasible, pollutant load reductions may be minimal.

For point sources, we assumed that facilities would pursue the lowest cost option for compliance with either baseline or revised criteria. However, without site-specific data and analysis, it is uncertain whether any particular control option would guarantee compliance.

In addition, there is uncertainty associated with the levels achievable with baseline controls. For both point and nonpoint sources, we assumed that in some cases baseline controls would result in compliance with revised criteria. It is not clear at which consumption rates the criteria would become low enough to warrant additional controls above and beyond those needed for compliance under the baseline, or whether additional reductions are feasible.

Estimated Rulemaking Timeline

Major Task	Estimated Completion
Develop draft proposed rule language and supporting documents Develop tables of criteria and proposed rule language, including any recommended implementation policies; Write or complete any additional documentation needed to support the proposed rules and provide an agency record.	January 2009
Public comment process and hearings Write rulemaking documents, publish notice of hearings and opportunity for comment in the SOS bulletin, mail notice to interested persons, hold hearings, and take written comment for 45 days.	April 2009
Respond to comments and finalize rule proposal Summarize public comment and hearing testimony, write responses, revise the proposed rules if appropriate, obtain internal review and review by partners (EPA and CTUIR) on final rule proposal.	June 2009
Propose rules for EQC adoption Write EQC staff report, including supporting documents for final proposed rules, develop presentation, and propose rules to EQC for adoption.	August 2009
Submit rules to EPA for approval File adopted rules with SOS, obtain AG certification on adoption, submit rule package to EPA for approval.	September 2009

Summary Points Supporting a Fish Consumption Rate of 175 grams/day

Over the last year, the Department of Environmental Quality, the Confederated Tribes of the Umatilla Indian Reservation, and U.S. Environmental Protection Agency have been listening to information on human health, costs and implementation from experts and stakeholders, and to input from the public at five public workshops. Priority considerations for all three governments include choosing a fish consumption value that is protective of known fish consumers and, when used as the basis for revised human health criteria, can be approved by EPA. The three governments have considered all the information they received and have coalesced around a state-wide value of 175 grams per day (6.2 ounces per day) as the fish consumption rate.

The three governments feel this is an appropriate choice for the following reasons:

- This value is protective and inclusive of the vast majority of fish consumers throughout the state of Oregon and will provide for consistent implementation throughout the state.
- 175 grams/day is the 95th percentile of known adult fish consumers from the Columbia River Inter-Tribal Fish Commission study. This study is Oregon's most relevant and reliable fish consumption survey.
- 175 grams/day is well supported by other regional studies of Pacific Northwest fish consumption as demonstrated by both the analysis of the Human Health Focus Group and DEQ staff.
- The value includes the consumption of salmon. Consumption of these fish is important to Oregonians.
- The value is from local data – EPA's guidance states that local data is its first preference when states are developing their own FCRs.
- An average consumption rate of 175 grams/day represents around 24 meals of fish per month (8 oz. servings). This value would be protective of Oregonians who are known to eat fish almost everyday (i.e. subsistence consumers).
- 175 grams/day is consistent with EPA's statements to Oregon and the CTUIR regarding fish consumption rates. EPA stated in August 2005 letters to the EQC and the CTUIR that a rate in the range of 105 - 113 g/day may be appropriate for some waters in Washington, Oregon and Idaho.
- The rate is also in keeping with EPA's default national recommendations for subsistence fishers. EPA's guidance recommends a default subsistence rate of 142 grams/day.
- The Warm Springs Tribe of Oregon used this rate as the basis for their human health criteria. They adopted revised criteria and EPA approved them in 2006. The Warm Springs Tribe's rationale (stated at FCR workshops) for adopting this rate is that it protects 99% of the children, which was their primary concern. Protecting the ability of Oregon children to safely eat Oregon fish is important to DEQ, EPA and the CTUIR. In addition, the HHFG has stressed the importance of focusing on safe fish consumption for children.
- 175 grams/day is the rate being used by the Portland Harbor Superfund project for evaluating risks under the Native American consumption scenario.

Item O Handout from DEQ Staff (2)

Human Health Focus Group Report on Fish Consumption

A Summary for the EQC

August 22, 2008
Debra Sturdevant, DEQ

DEQ
State of Oregon Department of Environmental Quality

Human Health Focus Group

Experts in toxicology, risk assessment and public health

Name	Affiliation
Pat Cirone, PhD	Retired Federal Scientist
Sue MacMillan	URS Corporation
Joan Rothlein, PhD	Oregon Health & Science University
Elaine Faustman, PhD	University of Washington
Ken Kauffman	Oregon Department of Human Services
Dave McBride	Washington State Department of Health

Questions Posed to HHFG

- What is the scientific evidence Oregon should rely on in selecting a fish consumption rate to use in setting State water quality standards?
- How should salmon be considered in selecting a fish consumption rate?
- To what extent are populations who consume more than 17.5 grams/day of fish at greater risk for health impacts?

HHFG Findings: Most reliable and relevant data

- Oregon - Columbia River Tribes:
  - CRITFC Fish Consumption Survey (1994);
- Washington - Puget Sound Tribes:
  - Tulalip and Squaxin Island Tribes Study (1996)
  - Suquamish Tribe Fish Consumption (2006)
- Washington - Asian and Pacific Islander
  - Seafood Consumption Study (1999)
- National - Total population:
  - EPA's Review of the CSFII (1998)

HHFG Findings

- 17.5 g/d does not reflect Oregon fish consumption
- The FCR should be based on fish consumers, not a per capita average
- A 90th or 95th percentile should be adopted to protect the population
- Current consumption may be suppressed

HHFG Findings: Salmon, Marine species

- Salmon should be included in the FCR
  - Primary fish choice for consumers
  - Route of exposure
- Looked at an alternative (relative source contribution), but did not feel that was sufficiently well developed at this time
- Marine species should be included
  - The studies don't differentiate near shore (Oregon waters) from open ocean species

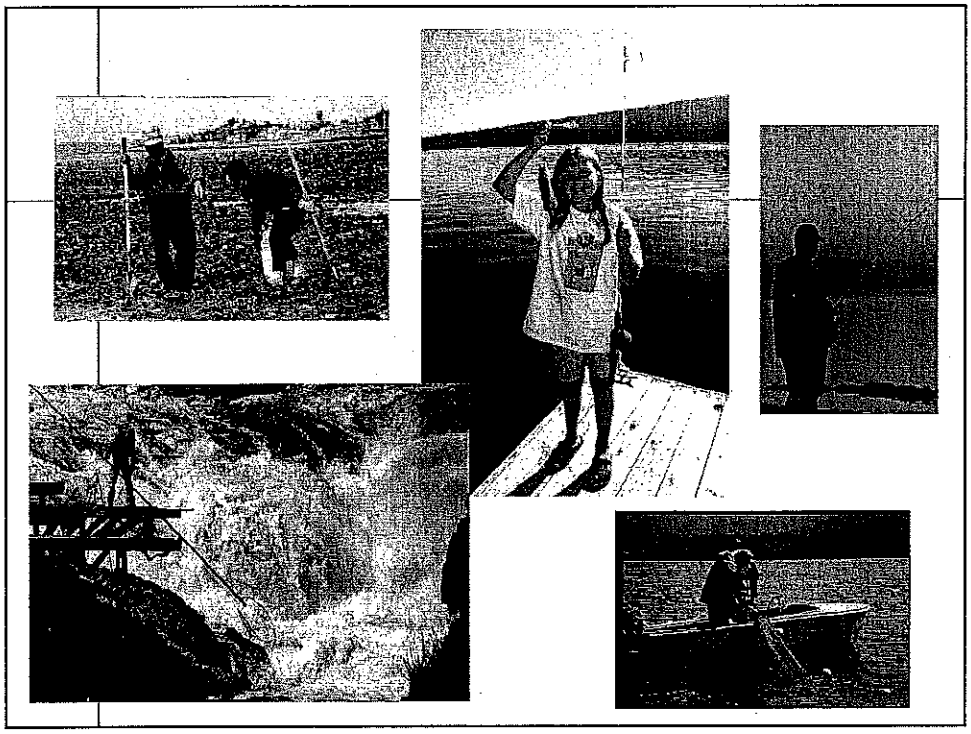
HHFG Findings: Risk

- People who eat > 17.5 g/d are at an increased risk of heart, kidney or liver disease, neurological and developmental effects, cancer, and other health effects
- Some populations are more vulnerable, based on age, gender, health status

HHFG Range of FCRs (in g/d)

Group	Median	90th	95th
Columbia River Tribes	40	**113**	**176**
Tulalip Tribe	45	186	244
Squaxin Island Tribe	43	193	247
Suquamish Tribe	132	489	NA
Asians & Pacific Islanders	78	236	306
U.S. Population - Consumers only	99	248	334

Pop as a whole 75 111

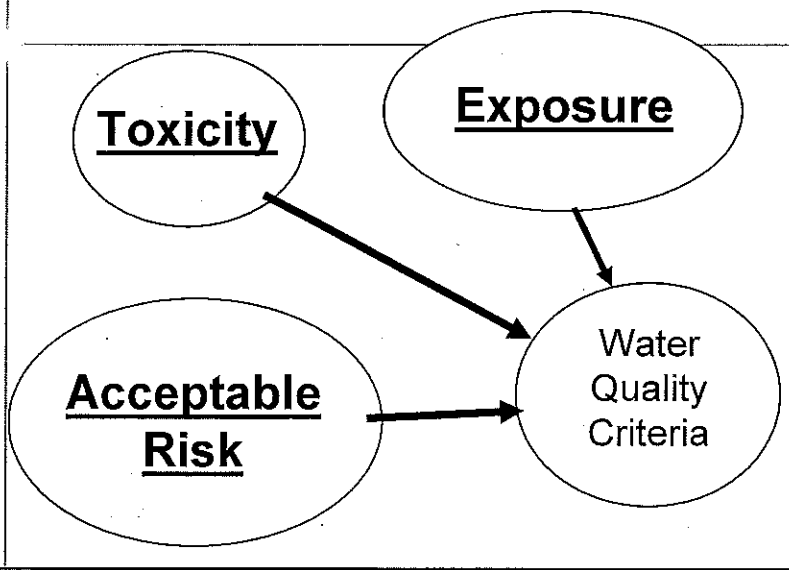


The FCR In Context

Setting toxic pollutants criteria
to protect human health

DEQ
State of Oregon
Department of
Environmental
Quality

Risk and Water Quality Criteria



Toxicity Factors used to Calculate Human Health Criteria

- Carcinogens (cancer causing):
  - Cancer slope factor
  - Acceptable risk: one additional incidence of cancer for every 1 million people (1:1,000,000)
- Non-carcinogens:
  - Reference dose – level below which no adverse health effects are expected to occur
  - Relative source contribution

Exposure Factors used to Calculate Human Health Criteria

- Body weight (average adult 70 kg, 154 lbs)
- Drinking water intake (2 liters/d, 90%ile)
- Fish consumption rate (grams/day)
- Bioconcentration factor

Relationship Between Fish Consumption and Criteria

- As consumption rate ⇧, criterion ⇩
- Magnitude of change is modified by the bioconcentration factor

⇧

Bioconcentration Factor

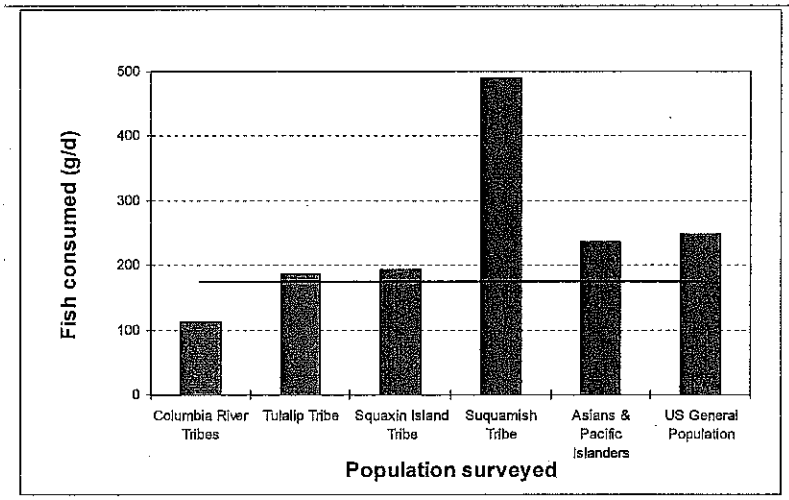
- How much a chemical tends to accumulate in organisms v. dissolve in water
- Varies by chemical
  - Range from 1 to 53,000+
- EPA provides national BCFs

In summary,

The fish consumption rate is an important, locally driven component of water quality criteria designed to protect human health.

The human health criteria are intended to protect people who eat fish and shellfish, whether that consumption is for health or economic reasons or based on a long cultural tradition.

Fish Consumption Surveys



Item O Handout from DEQ staff (3)

Water Quality Program

State of Oregon Department of Environmental Quality

Cost of Compliance: SAIC Report

Jennifer Wigal

EQC August 22, 2008 – Information Item O

Informational Report on the Fish Consumption Rate Project

Water Quality Program

State of Oregon Department of Environmental Quality

Overview

- Analysis conducted by EPA-funded contractor, SAIC
- Charged with estimating the incremental cost of compliance to meet revised water quality criteria based on a new fish consumption rate
- Analysis contains
  - Estimates of costs for point sources
  - Qualitative description of potential costs for nonpoint sources and stormwater
  - Estimates of government regulatory costs associated with variances and an increase in the number of impaired waters
  - Discussion of uncertainties and limitations
  - Approaches and results of implementation activities and relevant actions in other states

State of Oregon Department of Environmental Quality

Approach to Estimating Costs

- Selection of facilities
  - Reviewed 1 minor steel mill and 4 largest facilities (municipalities, one of which is dominated by industrial wastewater)
  - Representative random sample of 15 additional facilities (both municipal and industrial)
- Cost estimated between criteria in effect and revised criteria based on a range of fish consumption rates
- Assumptions
  - Facilities with higher flows are most likely to incur the greatest costs
  - Facilities would pursue least cost approach to compliance

Water Quality Program

State of Oregon Department of Environmental Quality

Findings: Point Sources

- Reductions in effluent concentrations needed for at least 6 pollutants to achieve baseline water quality criteria
- Additional reduction efforts under revised criteria would also likely be needed for 3 of those pollutants
- Sources would likely use one or more compliance approaches to meet revised criteria:
  - Some treatment
  - Pollution prevention programs
  - Inflow and Infiltration controls (relevant for Arsenic)
  - Variances
  - Intake credits

State of Oregon Department of Environmental Quality

Findings: Estimated Annual Point Source Costs

- Baseline
  - $3.62 to $3.92 million (not including inflow & infiltration costs)
  - $3.62 to $29.7 million (includes I&I)
- Revised Criteria
  - $75,000 to $1.82 million,
    - Low end -- costs attributable to 63.2 gpd FCR, no I&I
    - High end – costs attributable to 389 gpd, including I&I
  - Facility actions to comply with baseline also results in compliance with the revised standards
  - Majority of the costs attributable to meeting baseline standards

Water Quality Program

State of Oregon Department of Environmental Quality

Findings: Nonpoint Sources and Stormwater

- Pollutants where point source controls insufficient to meet revised criteria
- Pollutants where ambient concentrations exceed criteria
- Potential sources include
  - agricultural and forest lands,
  - storm water,
  - legacy mining,
  - atmospheric deposition,
  - natural sources and
  - municipal and industrial point sources
- Costs highly uncertain; could be significant

State of Oregon Department of Environmental Quality

Findings: Government Regulatory Costs

- Report estimates government regulatory costs associated with
  - Additional waters listed as impaired and subsequent TMDL development
    - Estimated to be $26,000 to $500,000 per TMDL
  - Processing applications for variances
    - Estimated one-time incremental cost of $65,000 under existing regulations
  - Other government costs outside the scope of work

Water Quality Program

State of Oregon Department of Environmental Quality

Uncertainties in the Analysis

- Data limitations
  - Effluent data
  - Ambient data
  - Controls and activities underway
- Potential pollutant load reductions achievable
  - Method quantitation limits
- Dischargers' response to potential revised requirements and permit conditions

Item O Handout from DEQ staff (4)

Overview of the Fiscal Impacts and Implementation Advisory Committee's (FIIAC) Work

A Presentation for the Environmental Quality Commission

Developed by FIIAC Co-Chairs:
Kristin Lee, ECONorthwest
Sarah Kruse, Ecotrust

What is FIIAC?

- Nine member advisory committee
- Names recommended to DEQ by variety of sources
- Representatives from tribes (2), public health (1), municipal water agencies (1), local government (1), industry (2), economic consulting firm (1) and economic innovation organization (1)
- Seven meetings to date, beginning January 29, 2008

Overview of FIIAC's Work

1. Review and comment on SAIC cost analysis
2. Listen to other cost analyses (from NWPPA and ACWA)
3. Discuss potential benefits
4. Discuss alternative implementation strategies
5. Note uncertainties and limitations
6. Provide conclusions and recommendations

SAIC Analysis

FIIAC members provided two rounds of comments on the SAIC analysis. Generally, these comments fell into the following categories:

- uncertainty about cost estimates;
- lack of thorough discussion of economic benefits;
- uncertainty/feasibility issues around variances and other non-traditional regulatory approaches in our region;
- the importance of distinguishing between baseline costs (at 17.5 gpd) versus the cost to comply with revised standards;
- lack of clarity/discrepancies in baseline information;
- uncertainty about sample representation; and
- lack of analysis on small business impacts.

SAIC Analysis

- Many of the comments submitted by FIIAC members were addressed by SAIC in the subsequent draft.
- The FIIAC plans to do a review of the most recent draft of the analysis but, due to extenuating circumstances, no consensus conclusions have been stated by the group at the time of this memo.

Other Cost Analyses

- Heard presentations of cost analyses by the Northwest Pulp and Paper Association and the Oregon Association of Clean Water Agencies
- FIIAC had opportunity to ask questions and discuss analyses, but no chance to review underlying assumptions or analyses of these studies
- FIIAC unable to make comparisons, conclusions or recommendations at this time

Cost Analyses

- SAIC assumed use of lowest cost approaches. Coupled with the lack of effective end-of-pipe controls for most of the issue contaminants, SAIC's approach largely involved toxics-reduction programs. SAIC also costed out end-of-pipe approaches, but didn't conclude that this would be the recommended approach.
- ACWA & NWPPA costed out ONLY end-of-pipe approaches—due to the current non-use of compliance strategies in Oregon other than end-of-pipe treatment.

Benefits

- DEQ did not have the time/funding for a benefits analysis
- That said, the FIIAC generally agreed that a fiscal impact analysis, by definition, should consider both costs and benefits
- The FIIAC also offers these thoughts on benefits:
  - Environmental protection entails both costs and benefits
  - Costs and benefits can be distributed across different groups and have varying levels of impacts on these groups
  - When either costs or benefits are "external" to the decision, the economic signals are distorted
  - Benefits would likely not be limited to fish consumers only

Benefits

- Because no analysis of benefits was done, the FIIAC created a table of *potential benefits* with the following caveats:
  - Point sources are likely a small component of all contaminant sources at a statewide scale
  - This is a list of categories of expected results for achieving water quality standards—and it is unknown what outcomes will actually result from this effort
  - This is not an exhaustive, definitive or predictive list
- Specific costs and benefits associated with alternative strategies were not analyzed either, but there was general consensus that some of these strategies may produce higher net benefits than end-of-pipe treatment alone

Answers to FIIAC Charge

The following bullets summarize responses to the questions specified in the FIIAC Charter, at the time of writing this memo:

- Would increasing the FCR have a fiscal and economic impact? **Yes**
- What is the extent of that fiscal and economic impact? **Uncertain, and, need to consider both costs and benefits.**
- Would increasing the FCR have a significant adverse impact on small businesses? **Not known at this time.**
- What is the extent of that fiscal and economic impact to small businesses? **More information needs to be gathered to answer this question.**

What FIIAC Can Say Today About a Revised Fish Consumption Rate:

- An increased FCR will have associated increased costs—especially with traditional approaches—the level of costs is dependent on the FCR and implementation strategies chosen
- It will take time for municipalities, industry and others to comply—the amount of time is likely to vary based on the FCR and the implementation strategies chosen
- Innovative approaches will be needed to attain the standard
- There will be benefits (but the level of those benefits have not been evaluated)
- A comprehensive approach is needed

Item O Handout from DEQ staff (5)

Oregon Fish Consumption Rate Project

Fiscal Impacts and Implementation Advisory Committee
Memo to the Oregon Environmental Quality Commission

The purpose of this memo is to provide an overview of the convening and charge of the Fiscal Impacts and Implementation Advisory Committee (FIIAC), to summarize FIIAC discussions around costs, benefits and implementation ideas that were considered by the group, and to highlight conclusions and recommendations that culminated from this effort. Further details of the FIIAC information can be found in the Appendices that include the "FIIAC comments and response to comments on Science Applications International Corporation (SAIC) Cost of Compliance analysis" (Appendix 1) and FIIAC Meeting Summary Notes (Appendix 2).

I. OVERVIEW INFORMATION

Background

The Oregon Fish and Shellfish Consumption Rate Project, a joint project of Oregon Department of Environmental Quality (DEQ), United States Environmental Protection Agency (EPA) and the Confederated Tribes of the Umatilla Indian Reservation (CTUIR), has been evaluating options to revise Oregon's fish consumption rate, which is one variable used to calculate water quality criteria protective of human health. This effort is anticipated to end in late 2008 when the Environmental Quality Commission (EQC) chooses a fish consumption rate for rulemaking.

By October 2008, DEQ, EPA, and CTUIR plan to present a report to the EQC on a range of options to revise the fish consumption rate, with a goal of one joint recommendation from those options. That report will include a range of proposed implementation options to be considered in implementing a revised fish consumption rate.

Ideally, for the three governments to develop feasible implementation options, the economic effects (both costs and benefits) of each option need to be understood. To that end, DEQ, EPA and CTUIR convened the FIIAC as a group of interested experts who could help to develop feasible implementation options and also provide input on the impacts such options may have on a wide range of permitted dischargers, the public, and other stakeholders throughout the state. The expertise of the group ranged from backgrounds in economics, business administration, public works, public health, water quality, and engineering. A list of FIIAC members is shown in Table 1.

Table 1: FIIAC Membership

Name	*Affiliation*
Deanna Conners	Oregon Dept. of Human Services (Public Health Division)
Kathleen Feehan	Confederated Tribes of the Umatilla Indian Reservation (Tribe)
Rich Garber	Association of Oregon Industries (Industry)
Sarah Kruse	Ecotrust (Economic Innovation Organization)
Kristin Lee	ECONorthwest (Economic Consulting Firm)
Eric Scott*	Confederated Tribes of the Grand Ronde (Tribe)
Susie Smith	Association of Clean Water Agencies (Municipalities)
Willie Tiffany	League of Oregon Cities (Municipalities)

Kathryn VanNatta	Northwest Pulp and Paper Association (Industry)

* Eric participated in the first four FIIAC meetings and was not able to remain on the committee through the completion of the process. Therefore he did not provide input to this FIIAC memo.

Committee's Charge

FIIAC's final Charter specified the following four charges as the focus of the group's work together:

1. Consider and possibly contribute to the Implementation Strategies Inventory that will be compiled by DEQ and used in developing implementation options for potential new human health criteria.
2. Review and comment on the Draft Fiscal Impact Analysis in accordance with ORS 183.333. The analysis will be used to develop DEQ's Statement of Need and Fiscal and Economic Impact in anticipation of a future rulemaking to raise the FCR and lower human health water quality criteria. The FIIAC will address the following questions in their review:
   - Would increasing the FCR have a fiscal and economic impact?
   - What is the extent of that fiscal and economic impact?
   - Would increasing the FCR have a significant adverse impact on small businesses?
   - What is the extent of that fiscal and economic impact to small businesses?

   In addition, it is anticipated that members of this Committee will be able to provide information about the economic benefits of an increased fish consumption rate; information about economic or other benefits of an increased fish consumption rate will be provided to the EQC to help inform their final decision.
3. Discuss implementation options for multiple fish consumption rate scenarios
4. Provide any recommendations on fiscal impact and implementation strategies

(From *FIIAC Final Charter, 1-28-08*)

II. DISCUSSION OF FISCAL IMPACTS

a. Cost Analyses

As noted above, FIIAC was asked to review and comment on a fiscal impact analysis. To broaden the views, FIIAC looked at analyses that were generated from three different perspectives: federal/state, municipalities and industry.

EPA/DEQ Analysis: Science Applications International Corporation (SAIC), an independent firm, was contracted by EPA on behalf of DEQ to develop and perform a "Cost of Compliance with Water Quality Criteria or Toxic Pollutants for Oregon Waters" analysis. This cost analysis likely will be used to develop DEQ's Statement of Need and Fiscal and Economic Impact for any formal rulemaking that may result if the EQC decides to change the Fish Consumption Rate. EPA presented the analysis and revisions of the analysis to the FIIAC. In turn, FIIAC discussed the report and provided individual written comments to SAIC/DEQ/EPA (attached as Appendix 1). What follows is a brief summary of the highlights discussed at FIIAC meetings:

SAIC randomly selected seventeen facilities in Oregon for its analysis. The report identified baseline cost, changes that would be needed to meet new criteria, and drivers of cost. The methodology used was similar to that of the Great Lakes Initiative and work done in California.

The methodology involved: choosing random samples from an identified list of potentially affected facilities; pooling all available data; applying new criteria; and costing out the required changes to meet the new criteria. The criteria used for running the analysis included criteria associated with the baseline fish consumption rate (the current rate of 17.5 grams per day) and increased fish consumptions rates of 63.2, 113, 175, 389 and 620 grams per day.

SAIC evaluated the potential cost of compliance for point source facilities. To arrive at these estimates, they evaluated the four largest facilities (four municipal facilities, one of which is dominated by flow from a pulp and paper plant) and one minor industrial (steel mill). To evaluate the potential for costs at the remaining municipal and industrial facilities within the state, SAIC selected a representative random sample of 13 major facilities and two minor facilities. SAIC calculated costs for both total and incremental (i.e., above and beyond those needed for compliance with baseline standards) annual statewide costs, both with and without the costs for inflow and infiltration (I&I) controls to reduce arsenic in municipal sewer systems. SAIC also estimated costs for a range of revised FCRs (from 17.5-620 gpd). SAIC's approach to estimating costs assumed that facilities would pursue the lowest cost means of compliance with effluent limits. The means of compliance SAIC considering in calculating facilities' actions to come into compliance included:

- Optimizing treatment processes (e.g., adding chemicals to increase flocculation or filtration efficiency) to increase pollutant removal efficiencies;
- Source control (e.g., pollution prevention program, inflow and infiltration reductions, more stringent pretreatment standards);
- Installing end-of-pipe treatment technology; and
- Alternative compliance mechanisms (e.g., site-specific criterion, TMDL, or variance).

Uncertainties exist around actual use of some of the approaches included in the SAIC analysis. That said, while some of these approaches have not been commonly used in Oregon, SAIC assumed approaches were available where allowed by Oregon law.

SAIC estimated the annual costs to comply with baseline standards could range from $3.62 to $29.7 million dollars if I&I costs are included ($3.62 to $3.92 million if I&I costs are not included). In calculating the annual costs to comply with any newly proposed standards, SAIC estimated the total annual costs, statewide, would range from $75,000 to $1.82 million, with the low end representing costs attributable to revised standards based on a 63.2 gram per day fish consumption rate without I&I costs and the high end representing revised standards based on a fish consumption rate of 620 grams per day including costs associated with I&I. Because these costs are based on an extrapolation of costs estimated for the sample facilities, costs are not expressed on a per million gallon day basis, rather, they are expressed as a total statewide annual cost.

In evaluating the available data, SAIC concluded that reductions in effluent concentrations would be needed for at lease six pollutants to meet baseline criteria: 4,4'-DDT, alpha BHC, arsenic, bis(2-ethylhexyl) phthalate, dioxin, mercury. Additional reduction efforts under revised criteria would also likely be needed for three of those pollutants: Arsenic, bis(2-ethylhexyl) phthalate, mercury

In calculating these costs, SAIC found that many of the actions facilities would need to take to comply with the baseline standards would also result in compliance with the revised standards.

As a result, they found that the majority of the costs are associated with meeting the current, baseline standards. However, as noted above, they found there will be some additional costs associated with standards based on a higher fish consumption rate.

For some of the pollutants (e.g. mercury, arsenic) that SAIC concluded would most likely need additional reduction efforts, treatment technologies have not yet been proven to treat to those levels anywhere in the U.S. As a result, SAIC assumed that permittees would pursue alternative compliance mechanisms (e.g., variances) when permit limits are unable to be met. (It should be noted that these types of compliance tools are currently not in use in Oregon). SAIC estimates that one-time expenditures associated with variance applications could range from $1.43 million to $7.05 million (total statewide) under the baseline; incremental variance-related expenditures could range from $0.59 million to $2.68 million (total statewide) under revised criteria.

For additional information, SAIC included a summary of estimated costs for reverse osmosis, if that treatment were to be used at a facility. SAIC estimated the annual cost of reverse osmosis (capital plus O & M) to range from $7.1 million to $56.7 million per facility, depending on the wastewater treatment flows within the facility.

With regard to nonpoint sources and stormwater, the SAIC report provides some information regarding potential controls and associated unit costs, where available. For minor and indirect dischargers, the report notes that costs are highly uncertain based on limited or no data. The one exception to this conclusion is mercury due to its ubiquitous nature. The report notes that mercury is likely to be a pollutant of concern for minor municipal dischargers, and estimates that annual statewide compliance costs could range from $0.8 million to $3.9 million for revised mercury standards based on a 620 grams per day fish consumption rate.

For the report as a whole, SAIC noted several uncertainties in its analysis associated with data limitations, potential pollutant load reductions achievable, and how dischargers would respond to potential revised requirements and permit conditions. For the facilities analyzed, data were not available for all pollutants for all sample facilities, resulting in an inability to assess whether facilities were currently in compliance with the baseline standards. In addition, many of the revised criteria, regardless of the fish consumption rate used as the basis, are below method quantification level. As a result, there may not be measurable or quantifiable load reductions from point sources. As a result of these uncertainties, the estimated costs may be either higher or lower than those estimated by SAIC.

FIIAC Member Comments on the SAIC Cost of Compliance Analysis

FIIAC members provided two rounds of comments on the SAIC analysis. These comments were provided by individual members or their organizations. Generally, these comments fell into the following categories:

- uncertainty about cost estimates;
- lack of overall government costs and accurate wastewater treatment costs;
- lack of thorough discussion of economic benefits, including potential avoided costs;
- significant questions and issues regarding costs associated with inflow and infiltration (I&I) and pollution prevention (P2);
- uncertainty and feasibility issues around the reliance on variances and other non-traditional regulatory approaches in a litigious region: Oregon and EPA Region 10;

- additional costs identified by members that were missing from the analysis;
- the importance of distinguishing between baseline costs (at 17.5 gpd) versus cost to comply with revised standards;
- lack of clarity/discrepancies in baseline information;
- questions about how representative the facility samples were for Oregon;
- lack of analysis on small business impacts; and
- suggested revisions to data formatting.

Many of the comments submitted by FIIAC members were addressed by SAIC in the subsequent draft. FIIAC plans to do a review of the most recent draft of the analysis but, due to extenuating circumstances, including a delay in the release of the second draft, no consensus conclusions have been stated by the group at the time of this memo.

Industry Analysis: the Northwest Pulp and Paper Association (NWPPA) and the Association of Oregon Industries (AOI) representatives shared information with FIIAC from a CH2MHill cost analysis report that was developed beginning in 2006. This report found that, similar to the SAIC analysis, metals are a driver for detection and, therefore, cost. Mercury and arsenic, both of which can be naturally occurring elements, showed highest detection levels. The summary information shared with the FIIAC included effluent data at NWPPA sites and the estimated costs for end-of-pipe controls and removal technology methods that could be or are used to address them.

At the June 27 public workshop, NWPPA presented summary information from its second cost study done by HDR Inc. This study was based on a fish consumption rate range of 63-389 grams/day. NWPPA emphasized that (per DEQ's information) most point sources do not yet have permits incorporating the current criteria based on 17.5 grams/day. The HDR analysis studied various wastewater treatment options and the advantages and disadvantages to using each. Four mill effluents were used to analyze capital costs for each treatment technology based on 175 grams/day. For a mid-sized Oregon mill discharging 19 million gallons per day, iron coprecipitation was estimated at $25 million, nanofiltration was estimated at $67 million and reverse osmosis was estimated at $79 million. Annual operating and maintenance costs estimated for iron coprecipitation was $20 million, nanofiltration was $6.7 million and reverse osmosis was $7.4 million. Finally, annualized costs were estimated, over a 10-year period, for iron coprecipitation at $24 million, for nanofiltration at $16 million, and at $19 million for reverse osmosis. These estimated costs were compared to current yearly operation and maintenance costs for wastewater treatment, which were estimated to be approximately $3 million.

Municipalities' Analysis: The Association of Clean Water Agencies (ACWA) also shared summary information with FIIAC about the estimated costs to municipalities of implementing a higher fish consumption rate in Oregon. Again, metals and organic chemicals were of highest concern and, as a result, ACWA suggested that effective implementation and management should focus on pretreatment programs and pollution prevention.

ACWA estimated that capital costs for micro-filtration and reverse osmosis technologies to address metals would cost between $2.5 million and $3.5 million per million gallons per day, assuming some portion of the final effluent to be blended prior to discharge. Without blending, capital costs were estimated at about $6 million to $15 million per million gallons per day.

Based on these cost estimates, the ACWA information showed a combined capital cost range of $2.3-$3.3 billion for all of the four largest wastewater treatment systems in Oregon, including Portland, Clean Water Services, Eugene/Springfield and Corvallis. At the time of this memo, ACWA had committed to analyzing these broad costs to show what this would mean to ratepayers, and planned to provide that information to DEQ as soon as it is available. ACWA did note that operating costs to comply with an increased fish consumption rate would be significant, and those costs would include substantial energy consumption, chemical usage, ongoing operating and maintenance and disposal of briny sludges.

FIIAC Member Comments on the Industry and Municipalities Cost of Compliance Analyses
FIIAC heard presentations on the cost analyses noted above, but did not have the opportunity to analyze either of these analyses to the same extent that it reviewed the SAIC analysis. Summary information was shared and discussed at two FIIAC meetings and at the June 27 public workshop. Information about baseline assumptions, underlying data, calculations, or methodologies of these analyses were not made available nor were they a part of FIIAC discussions. As such, most FIIAC members noted that the industry and municipal cost analyses were not able to differentiate between the costs associated with current baseline criteria compliance as opposed to costs to comply with future criteria based on a potential increase in the fish consumption rate. It also was not possible to identify different costs associated with the different potential future fish consumption rates. As a result of this and time constraints related to this process, FIIAC was unable to reach any consensus conclusions about the analyses themselves or overall costs that will be associated with an increase in Oregon's fish consumption rate.

b. Benefits Discussions

As noted above, DEQ did not have the time or funding to research and do a quantitative analysis of the direct and indirect potential benefits of increased fish consumption rates. Because of this, members of the FIIAC worked together to provide initial information about the potential benefits of an increased fish consumption rate and also shared ideas for how DEQ could best reflect potential benefits within the time and fiscal constraints of this process (see attached "Potential Economic Benefits from an Increased Fish Consumption Rate".

FIIAC was provided with information from FIIAC members, the Oregon Environmental Council and DEQ relative to benefits. FIIAC members generally agreed that a fiscal impact assessment, by definition, should consider both costs and benefits. However, no specific consensus conclusions or recommendations related to benefits have come from FIIAC at this point. FIIAC members shared economic principles in FIIAC meetings, at the June 27 public workshop and shared here for the EQC:

- Environmental protection entails both costs and benefits and there are multiple ways that a healthy environment provides economic value.
- Costs may be easier to quantify than benefits, and benefits are equally important to understanding overall impacts.
- Costs and benefits can be distributed differently across public, business, and society at large and have different impacts on different groups.
- When either costs or benefits are "external" to the decision, the economic signals are distorted.

- Benefits from a revised FCR would likely not be limited to fish consumers only. A key outcome of a revised FCR that actually resulted in achieving more stringent water quality criteria would be a reduction in toxic contamination in waterways and an overall improvement in water quality.

Based on information shared with the group about economic benefits analysis, FIIAC members worked together to provide examples of the kinds of potential benefits that might result from setting a fish consumption rate and meeting water quality standards. The list of potential benefits was generated by the group and shared during the public workshop (see Table 2):

Table 2: Potential Benefits of Raising the Fish Consumption Rate and Meeting the Standards

Benefit	***Examples***
Human Health	Safe drinking water; avoided costs from environmentally attributable diseases; reduced risk for those who do eat fish; recreational – reduced risk from water contact
Environmental	Water reuse opportunities from cleaner effluent; business—cleaner intake water for downstream industries; ecosystem health; tourism; amenity/aesthetic/property values; avoided costs to industries and utilities; fewer contaminants; fishing – tribal, commercial, recreational and subsistence; improve other species in the food chain: birds, etc.; higher quality water supply
Cultural	Enable religious/ceremonial activities; children; healthy fish – icon of the Northwest and local, sustainable food options

Potential Benefits of Specific Implementation Strategies

Strategy	***Potential Benefits***
Toxic Reductions	Reduced human health impacts; innovative possibilities used to reach more efficient systems when not fearful of litigation stemming from strict liability regulatory framework; costs of litigation reduced; reduced O&M; reduced hazardous waste removal costs;

	reduced energy costs and associated emissions
Stormwater Control	Co-benefits for toxics reductions and control of other important stressors that affect fish health such as sedimentation and warm water temperatures
Infiltration and Inflow (I&I)*	Reduce quantity of water and toxics entering plant, reducing operating costs

(* It should be noted that ACWA agencies are already engaged in I&I programs and do not agree that an incremental increase in I&I will result in toxics reduction and question the efficacy of additional increases in I&I rehab work since 100% I&I removal is currently not possible.)

Given the discussions and input from FIIAC members, the following caveats relative to both lists of potential benefits are noted:

- point sources are likely a small component of all contaminant sources at a statewide scale;
- this is a list of categories of expected results for achieving water quality standards – and it is unknown what outcomes will actually result from this effort; and
- this is not an exhaustive, definitive or predictive list.

FIIAC heard from one of its members that, generally, an implementation strategy that achieves the same pollutant reduction at a lower cost may have higher net benefits and that some of the alternative approaches considered by FIIAC may produce additional benefits that are not yet known. The distribution of costs and benefits across affected stakeholders may differ across implementation strategies.

The FIIAC did not examine specific costs and benefits associated with any of the alternative strategies, but there was general consensus that some of the alternative implementation strategies may produce higher net benefits than end-of-pipe treatment alone. The amount and type of benefits depend on the extent to which a higher fish consumption rate actually reduces pollutant levels. Strategies that reduce pollutants more quickly, achieve more pollutant reductions and/or have a greater certainty of achieving reductions will have higher benefits. Finally, both benefits and costs need to be considered to best understand the overall economic effects of a revised fish consumption rate and for optimal economic outcomes to be achieved in Oregon.

c. General Comments about FIIAC Fiscal Impact Discussions and Areas for Future Refinements

This memo would not be complete without noting that funding from EPA supported the SAIC analysis of the estimated costs associated with changing Oregon's fish consumption rate. Costs for studies related to industry and municipalities were born by those entities. However, funds were not available to support an analysis of potential benefits associated with an increased fish consumption rate during this process. Instead, CTUIR and two FIIAC members provided assistance for researching studies on the economic benefits of water quality improvements and toxics reduction programs. FIIAC members themselves undertook the remainder of the analysis presented above. FIIAC's discussion of impacts to small businesses was limited by the fact that NWPPA and AOI were the only industry representatives at the table and there was neither time

nor data in this stage of the process for DEQ or others to do a more in-depth analysis of the potential economic impacts to other small businesses beyond ongoing outreach efforts. Several FIIAC members pointed out that small businesses that discharge to pretreatment systems under industrial user permits had not been fully quantified or identified, nor had they been included in the SAIC, NWPPA or ACWA cost reports--in discussion or analysis. That said, DEQ committed to continue outreach efforts to other potentially affected industry interests, and expects more engagement to occur after an EQC decision is made on this issue, especially if DEQ begins its rulemaking process in 2009.

III. DISCUSSION OF IMPLEMENTATION STRATEGIES

At the request of DEQ, EPA and CTUIR, the FIIAC developed and refined a list of potential compliance implementation strategies in an Implementation Matrix over the course of several FIIAC meetings (see attached "Implementation Matrix"). The matrix includes a series of possible implementation approaches and some of the potential advantages, disadvantages, relative costs, regulatory status and outcomes associated with them. Most FIIAC members agreed that the matrix should be viewed as a fairly comprehensive list of ideas that DEQ should consider now and in the future in order to implement a new fish consumption rate. Some members felt strongly that regulatory certainty and legal assurances must be provided by DEQ and EPA in order for the 'non-traditional' options to be considered viable prior to moving forward with implementation of a revised fish consumption rate. While most FIIAC members agreed it is important to be realistic about the feasibility of implementing new approaches in the near term (i.e. three to five years), due to legal uncertainties and uncertainties about funding to support new measures, they also suggested that *all* potential ideas should be put forth for further examination and perhaps future use.

From the matrix, the FIIAC began to formulate ideas around options that lead to a 'comprehensive approach to toxics reduction'. Some members felt that the primary focus of such an option should be on the major human health based contaminants of concern, and then move on to Reasonable Potential Analysis problems in individual permits. Toxics reduction options might include several of the individual approaches listed in the matrix. FIIAC members agreed that, to take a comprehensive approach, a compliance schedule will likely be needed in order to move into the other regulatory compliance tools under the Clean Water Act. Some FIIAC members noted that none of the regulatory compliance tools are currently being used in Oregon permits although they may be in use in other parts of the country. Some FIIAC members also shared the hope that compliance schedules *will* be used as a tool in the future, and suggest that a decision is needed soon about the feasibility of using this tool in Oregon: to be a realistic tool, any such decision should be properly documented to provide credibility and certainty to potential users of the tool. It should be noted that some FIIAC members expressed concern that moving forward without legal assurances for the creative tools and options included in the matrix would have unknown and worrisome consequences for permittees.

FIIAC explored the broader matrix via a "Path to Compliance Matrix." Three alternative pathways to compliance were discussed:

1) Technology-based advanced treatment to meet effluent limits based on the revised standards. Compliance schedules would be needed, as well as "pass-through" credits (also known as intake credits) and variances.

2) A toxics reduction program plus 'best conventional treatment.' Compliance schedules would be used, coupled with a toxics reduction program and best conventional treatment in the first permit cycle. Then, if met, continue with a compliance schedule or, if not met, consider additional pollution prevention and or reduction approaches, look at other tools such as variances, use attainability analyses (UAA), pass-through credit, and/or offsets/trading.
3) Use of a water quality benchmark in the first permit cycle. The objective for this would be to provide less legal liability for the permittee than using a numeric limit in the permit. The same tools might be used for the first permit cycle, then the second cycle could use a compliance schedule, variance, pass through credits, UAA and/or offsets/trading.

FIIAC members were leaning towards the second approach, yet some members noted that the details of the approach still need to be fleshed out before they are comfortable supporting it. Those who had concerns noted that permit holders must comply with the Clean Water Act. The current strict liability emphasis of statutes in Oregon requires end-of pipe treatment and, without regulatory off-ramps, permit holders will be required to install yet unproven treatment technology. Yet, in general, the FIIAC had concerns about relying solely on current end-of-pipe treatment technologies to achieve effluent limits (first approach), due to feasibility issues. Some FIIAC members were interested in the benchmark approach for the first permit cycle as it is similar to the mechanism that has been used in the stormwater permitting program, and it would provide permittees the time and opportunities to determine what technologies and programs will and won't work to achieve compliance. Other FIIAC members expressed concerns about setting a benchmark rather than a numeric effluent limitation based on water quality standards in the third approach as it reduces the enforcement mechanisms that would otherwise be available. Additional options proposed for consideration by NWPPA and AOI are included on page 3 of the Implementation Matrix: D*e minimus* and Bifurcated criteria. To aid understanding of the above approaches, DEQ developed a flow chart that demonstrates how a permittee might apply some of the suggested compliance strategies (see attached "DEQ Implementation Flow Chart".

The Implementation Matrix provides analysis of the technical, legal, political and economic feasibility of the various implementation options. Some FIIAC members felt these concerns will need to be addressed prior to the option being employed by DEQ.

IV. BRIEF SUMMARY OF ANSWERS TO FIIAC CHARTER QUESTIONS

The following bullets summarize responses to the questions specified in the FIIAC Charter, at the time of writing this memo:

- Would increasing the FCR have a fiscal and economic impact? **Yes**
- What is the extent of that fiscal and economic impact? **Uncertain, and, need to consider both costs and benefits.**
- Would increasing the FCR have a significant adverse impact on small businesses? **Not known at this time.**
- What is the extent of that fiscal and economic impact to small businesses? **More information needs to be gathered to answer this question.**

V. CONCLUSIONS AND RECOMMENDATIONS

At this time, the FIIAC has reached no consensus on the anticipated costs or benefits of a revised FCR. A broad range of information was shared with the FIIAC over the course of six months of work together that led the group to draw some general conclusions. The degree of uncertainties and limitations such as varying perspectives on the assumptions imbedded in each of the cost analyses, lack of funds to support a comprehensive benefits analysis, and a lack of cost and benefits analysis for the specific and various alternative implementation strategies the group discussed, affected the FIIAC's ability to draw strong conclusions or provide consensus recommendations to the EQC at this time.

Still, there are some statements the FIIAC can make for the EQC to contemplate when considering whether or not to increase Oregon's fish consumption rate:

- It will take time for municipalities, industry and others to comply with water quality standards that would result from a higher fish consumption rate, and the amount of time needed is likely to vary based on the FCR and implementation strategy chosen.
- Based on the cost analyses provided for this effort, a higher fish consumption rate and resulting water quality criteria will have increased costs associated with it. This is especially true if permit holders are limited to installing end-of pipe treatment technology to meet more stringent water quality standards The level of costs depends on the implementation strategies available.
- Benefits will be accrued from meeting a water quality standard (and the level of those benefits depends on the degree to which pollution reduction is achieved).
- Traditional technology treatments that would be needed to meet more stringent water quality standards if only an end-of-pipe approach is used have not yet been proven to be effective. Therefore, innovative regulatory approaches, beyond installing end-of-pipe treatment technologies, are needed to help attain the standard. Because many of the tools that might be utilized to implement an innovative regulatory approach have never been used in Oregon, it is hoped that a decision to allow appropriate use of compliance schedules is made soon.
- The state should set an approvable standard that protects all fish consumers in Oregon, and the implementation approach to achieve that standard should be:
    - innovative;
    - comprehensive;
    - able to be implemented;
    - cost effective;
    - integrated across point-source and non-point source boundaries; and
    - provide for reasonable legal assurances/safety net.
- The broader state-wide focus to achieve good water quality should be on pollution prevention and toxics reduction measures.

This memo is respectfully submitted to the EQC by DS Consulting on behalf of the Fiscal Impacts and Implementation Advisory Committee
August 13, 2008.

POTENTIAL ECONOMIC BENEFITS FROM AN INCREASED FISH CONSUMPTION RATE

A Working Discussion Piece Prepared in Support of the FIIAC[1]

June 2008

The economic evaluation of environmental regulation is frequently narrowly focused on the costs of proposed rules to the regulated community. While these costs may be significant, the FIIAC believes that it is equally important to understand that environmental regulation frequently results in benefits. These benefits are often overlooked in the economic analysis portion of rulemaking processes.

This paper will qualitatively discuss the potential economic benefits that may result from an increased fish consumption rate. Where available, the discussion will use local data demonstrating economic benefits from increased pollution control (a direct result of increasing the fish consumption rate). In some situations, non-local data is used merely to illustrate potential benefits that could be realized in Oregon from increased water quality. This paper is not intended to posit that a certain dollar amount of benefits will accrue in Oregon, but rather, is meant to be read in light of the discussion of potential costs of an increased fish consumption rate, and show that while there will be likely costs associated with an increased fish consumption rate, there will also be likely benefits.

Human Health Benefits

Any reduction in the total toxic load in Oregon waterbodies is likely to have a positive effect on the human health of Oregonians. This will translate into an as yet unknown economic benefit through avoided costs. A recent study by the Oregon Environmental Council determined that environmentally attributable diseases, like cancer, birth defects, and neurobehavioral problems, and the direct and indirect costs of treating and caring for people afflicted by these diseases costs Oregonians at least $1.57 billion annually.[2] This cost only represents the fraction of the cost of treating and caring for persons with diseases that can be reasonably attributed to environmental contaminants, meaning they are conservative estimates. While some of the diseases in the report, and thereby the costs, do not arise from water or fish borne toxics, the report highlights that "policy, and in particular, environmental health policy, fails to fully consider the environmentally attributable economic costs of diseases and disabilities."

While the Price of Pollution study only briefly discussed specific causes of environmentally attributable diseases, other studies have highlighted the human health risk posed by the consumption of fish. The following table, drawn from the Lower Columbia River Bi-State Program's 1996 Human Health Risk Assessment, shows the cancer risk posed by the consumption of fish from the Columbia River[3]:

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[1] Prepared by Ryan Sudbury, Confederated Tribes of the Umatilla Indian Reservation

[2] Oregon Environmental Council, *The Price of Pollution*, 2008. Pg. iii.

[3] Tetra Tech. *Assessing Human Health Risks from Chemically Contaminated Fish in the Lower Columbia River*, 1996. Pg 5-5 (assumes a 70 year exposure timeframe).

	Chinook	Carp	Sucker	Sturgeon	Steelhead
6.5 g/day	18 cancers in 1,000,000 exposures	160 cancers in 1,000,000 exposures	37 cancers in 1,000,000 exposures	54 cancers in 1,000,000 exposures	5.6 cancers in 1,000,000 exposures
54 g/day	150 cancers in 1,000,000 exposures	1,300 cancers in 1,000,000 exposures	300 cancers in 1,000,000 exposures	450 cancers in 1,000,000 exposures	46 cancers in 1,000,000 exposures
176 g/day	490 cancers in 1,000,000 exposures	4,400 cancers in 1,000,000 exposures	1,000 cancer in 1,000,000 exposures	1,400 cancers in 1,000,000 exposures	150 cancers in 1,000,000 exposures
The Oregon DEQ target for potential cancer risk is 1 excess cancer in 1,000,000 exposures.					

Salmonids and resident fish showed similar patterns of potential risk from noncarcinogenic health threats, such as developmental and central nervous system impairments. Reducing toxics in Oregon's water and fish will reduce the costs associated with treatment and care of environmentally attributable diseases, and will result in a positive economic benefit to Oregonians.

Oregonians may receive additional economic benefits in terms of reduced health care costs due to consumption of greater amounts of fish, in place of other meat sources. For those who eat fish for the health benefits, the increased abundance of healthy local fish may also reduce costs associated with the purchase of fish from more remote locations (i.e. Alaska, etc.), resulting in an economic benefit for the consumer.

Salmon Restoration Benefits (and Reduced Costs)

Recovery of threatened and endangered salmon and steelhead costs Oregon hundreds of millions of dollars a year. The costs are incurred because of increased regulation; higher electricity prices; expense of public funds for recovery and mitigation programs; etc… A portion of this expense is related to toxic contamination in Oregon's waterways. A recent report released by the Lower Columbia River Estuary Partnership found that by some estimates, exposure to toxic contaminants causes delayed, disease-induced mortality of up to almost ten percent of all the juvenile Chinook salmon that move through the estuary.[4] This figure does not include the mortality caused by failure to avoid predators as a result of toxic exposure, which if included, would increase the mortality rate. The toxics issue is of such great importance that NOAA Fisheries ranks the need to address toxic contaminants in the top seven of twenty-two suggested actions to improve juvenile salmonid survival in the lower Columbia River.[5]

The reduction of toxics in Oregon's waters may not only reduce the costs associated with salmon recovery, but it may also increase the economic benefit derived from recreational and commercial fishing. A report released in 2005 concluded that restored salmon and steelhead

[4] *Lower Columbia River Estuary Partnership, Lower Columbia River and Estuary Ecosystem Monitoring: Water Quality and Sampling Report. 2007.*
[5] *Ibid.*

fisheries would result in $544,000,000 of annual economic benefits to the state of Idaho alone.[6] Economic benefits to Oregon and Washington may be similar, if not higher, based on a higher population of fish and people in the lower Columbia River Basin.

Recreational and Aesthetic Benefits

Reduced toxics in Oregon's waterways will likely increase recreational fishing and tourism to swimming and fishing locations throughout the state. Healthy, clean fish may help- restore fish as an icon of the northwest, and increase tourism to the region. Additionally, cleaner rivers and fish may lead to increased birding and wildlife viewing opportunities, as the benefits of cleaner fish work themselves up the food chain, resulting in substantial economic benefits.

While these statewide values are difficult to calculate or predict, a study of the Willamette basin found considerable recreational and aesthetic economic benefits resulting from water quality improvements as a result of point source pollution controls[7]. The study found that for the time period between 1972 and 1992, point source pollution controls resulted in between $275 million and $594 million worth of annual recreational and aesthetic economic benefits for the Willamette basin.[8] The study defined recreational and aesthetic uses as including recreational fishing, swimming, wildlife viewing, and general aesthetic benefits (using a Willingness to Pay for protection theory).These numbers indicate that cleaner water (and by connection, cleaner fish and wildlife) results in significant economic benefits for Oregon and its citizens.

Property Values Benefits Associated with Less Toxic Water Bodies

A reduction in toxics found in Oregon waterways may lead to increased property values for properties located near rivers or lakes. A recent study from the Great Lakes region estimated that property values were significantly depressed in two regions associated with toxic contaminants (PAHs, PCBs, and heavy metals). The study showed that a portion of the Buffalo River region (approx. 6 miles long) had depressed property values of between $83 million and $118 million for single-family homes, and between $57 million and $80 million for multi-family homes as a result of toxic sediments. The same study estimated that a portion of the Sheboygan River (approx. 14 miles long) had depressed property values of between $80 million and $120 million as the result of toxics.[9] While this study related to the economic effect of contaminated sediment, the idea that toxic pollution depresses property values is easily transferable to Oregon. A reduction in toxic pollution in Oregon waters may have a substantial economic benefit to property values in close proximity to Oregon waterways, and also result in additional property tax revenues to pay for state programs.

Benefits and Reduced Costs of Cleaner Drinking Water

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[6] Ben Johnson & Associates, *The Potential Economic Impact of Restored Salmon and Steelhead Fishing in Idaho*. 2005.

[7] Environmental Protection Agency, *A Benefits Assessment of Water Pollution Control Programs Since 1972*, Part I, EPA-EE-0429 (2000). Pg. 6-15–6-29.

[8] *Ibid.*

[9] *Economic Benefits of Sediment Remediation*, <http://www.nemw.org/Econ%20Ben%20Report06%20braden.pdf> (last accessed June 20th, 2008).

Much of Oregon's drinking water comes from surface water sources. The Willamette Basin had ninety-four million gallons of drinking water withdrawals in 1990 alone.[10] Oregon's drinking water stands to become cleaner as a result of an increased fish consumption rate and the associated stricter water quality standards. There are numerous economic benefits and averted costs associated with cleaner drinking water. Water suppliers may benefit from lower pretreatment costs and averted costs from needing to obtain water from headwaters sources. There are also the avoided costs of aversion behaviors, such as buying household pretreatment/water filtration systems, and bottled water, which costs between 240 and 1,000 times as much as tap water[11] and the containers need to be recycled or disposed of in landfills. Reduced toxics in Oregon's waters may result in real economic benefits in terms of reduced household and producer expenses.

Reduced Costs to Downstream Surface Water Users

Fewer toxics in the river may reduce costs incurred by downstream surface water users, who have to pre-treat water for industrial or commercial use (i.e. food processors). Additionally, reduced toxics in the water column may also reduce costs associated with end-of-pipe treatment for downstream water users, as they will not need to remove toxics present at the intake source.

Benefits from Potential Implementation Strategies

The FIIAC is discussing alternative avenues to address implementation issues associated with an increased fish consumption rate. Some of the non-traditional implementation strategies would have associated economic benefits. Off-site toxic mitigation programs, in place of additional end-of-pipe treatment, would cleanup legacy toxics, thereby increasing the magnitude of the potential economic benefits discussed above. Increased stormwater controls to reduce the inflow of toxics into surface waters may result in economic benefits related reduced erosion and sedimentation of waterways, and increased fish health and abundance from reduced stormwater pollution and stream temperature (i.e. reduced water runoff from hot pavement).

Conclusion

While economic benefits of environmental regulation are sometimes difficult to quantify, the FIIAC believes it is important to acknowledge that such benefits are likely to be realized given an increased fish consumption rate, and as such deserve equal consideration in the decision-making process. Decreased health care costs, increased property values, additional recreational and commercial fishing opportunities, and cleaner drinking water, among others, are all potential benefits that may result from an increased fish consumption rate and, therefore, these potential economic benefits should be considered during any economic analysis of an increased fish consumption rate.

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[10] Environmental Protection Agency, *A Benefits Assessment of Water Pollution Control Programs Since 1972*, Part I, EPA-EE-0429 (2000). Pg. 6-14.

[11] *The Real Costs of Bottled Water*, San Francisco Chronicle, Feb. 18th, 2007, < http://www.sfgate.com/cgi-bin/article.cgi?f=/c/a/2007/02/18/EDG56N6OA41.DTL> (last accessed June 21st, 2008).

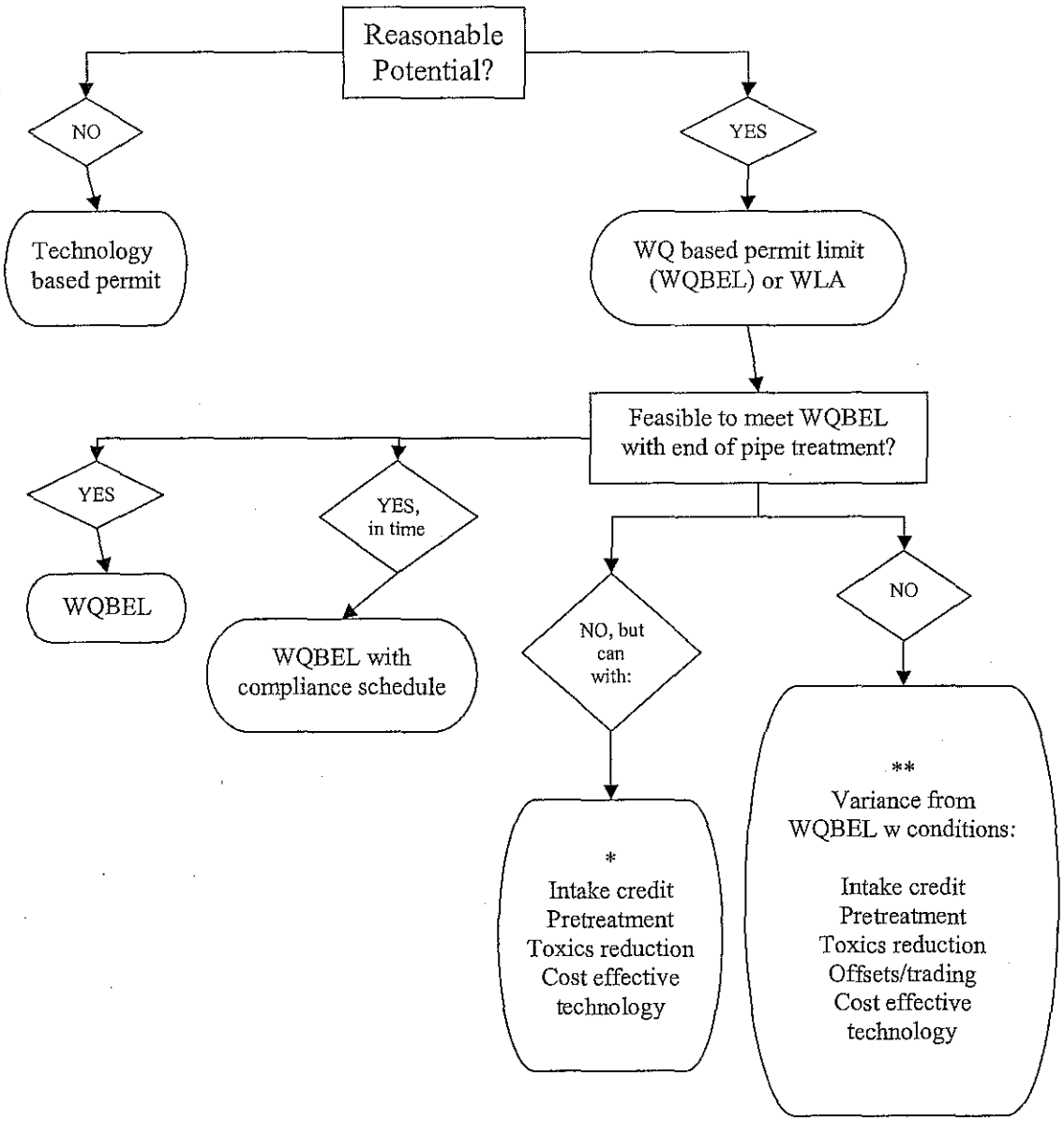


Figure 1. Implementation framework for permitted point sources that have a reasonable potential to exceed the applicable criteria.

*Quantitative analysis will be needed to show attainment with the WQBEL. A compliance schedule may be needed.
**Variances could be done for individual sources or multiple sources in similar circumstances.
Note: The measures in these boxes be used in combinations.

Measures that involve modifying the applicable criteria include:

- Site specific criteria, i.e. based on natural background levels or other site specific conditions (criteria must protect designated use).
- Beneficial use revision or removal/UAA. (For example, are there some water bodies that should not be designated as drinking water sources.)

Item O Handout from DEQ Staff (6)

Pathways to Compliance
DRAFT

16-Jun-08

Regulatory Approach	Compliance Approach	Regulatory Tools 1st Permit Cycle	*Regulatory Tools* 2nd Permit Cycle
Water Quality Standard	>Numeric Limit in Permit >Technology based (advanced)	Compliance Schedule Variance Pass through or intake credit	UAA? Variance Pass through / intake credit Offsets / trading
	>Numeric Limit in Permit >Toxics Reduction Programs plus Best Conventional Treatment	Compliance schedule Toxics Reduction Program implement monitor	If # met - continue with no compliance schedule If # not met: Variance, UAA? Pass through/intake credit Offsets/trading
	>WQ Benchmark in Permit >ToxicsReduction Programs plus Best Conventional Treatment	Analysis to determine sources & reduction methods Develop & Implement Toxics Reduction program Benchmarks would work like Phase I stormwater permits	Compliance schedule Variance Pass through / intake credit UAA? Offsets / trading

Item O Handout from DEQ Staff (2)

Item O Handout from DEQ Staff (8)

FIIAC Committee Presentation to Environmental Quality Commission 8/22/2008

Chair Blosser and Commissioners,

My name is Rich Garber, I am the corporate environmental manager for Boise Inc. It has been my pleasure to serve on the DEQ's Fiscal Impacts and Implementation Advisory Committee (FIIAC) these past 8 months as the representative for Associated Oregon Industries (AOI).

As the AOI representative on the FIIAC committee, I felt it was not only important to represent the interests of small business and industrial point source dischargers and NPDES wastewater permit holders in the discussion regarding impacts of an increased fish consumption rate; but to also bring my NPDES permitting experience and knowledge to the committee as someone who has worked for nearly 20 years applying for, negotiating, reviewing, and implementing the many requirements of NPDES permits at industrial facilities. Based on my experiences and knowledge of the NPDES permit process, I would like to offer a few brief comments and concerns regarding an increase in Oregon's fish consumption rate and the related impacts.

1. Under Oregon's existing rules (and EPA and DEQ's implementation and interpretation of them) most, if not all, of the flexible implementation options that the FIIAC and DEQ have discussed are not currently in use in Oregon. The one option that has been used by ODEQ in the past (compliance schedules) is currently under litigation with EPA.
2. The Clean Water Act, as a strict liability statute, places the burden of compliance on the NPDES permit holder. Companies that hold NPDES permits need to be legally certain that they meet the terms of their permits in order to conduct their business and make investments in their facilities. Permit holders want to comply with their permit limits 100% of the time! Where regulatory and legal uncertainty exists it will be disruptive to Oregon's businesses.
3. Traditional end-of-pipe compliance and controls would be extremely costly (multiple billions) for Oregon's small businesses, industry and municipalities, if required to meet the revised fish consumption rate and accompanying changes in water quality criteria. Currently, these end-of-pipe controls are unproven for large wastewater treatment systems, and would require many years of research and study specific to each facility with its unique wastewater characteristics. Even if these controls could be afforded, technical feasibility is unknown.
4. An increase in the fish consumption rate and accompanying reductions in the state's water quality criteria must be **practically implementable** for Oregon's industry, municipalities, small businesses, and the DEQ. Implementation rules must pass EPA scrutiny, and (ultimately) that of the public and legal community.
5. Without first having the necessary NPDES implementation tools (examples discussed: pass through credits, de minimis, technical or economic feasibility off-ramps, etc.) available for use in Oregon statutes, approval of an increased fish consumption rate and accompanying revisions to water quality criteria would place Oregon's municipal, industrial and small business permit holders on precarious legal footing with regard to their NPDES permits. This type of regulatory and legal uncertainty would not be good for Oregon's business climate, and could result in a great deal of litigation costs for all involved, rather than a reduction in toxics in fish and improved tribal and consumer health.

These concerns are raised in the spirit of good faith and cooperation with this commission and the DEQ, and with the shared interest in working toward efficient, practical and legally valid solutions for implementation of any revision to the fish consumption rate. Thank you for allowing me to present this to you today, and for your time and consideration of these comments.

Agenda Item O: Informational Report on the Fish Consumption Rate Project EQC
August 22, 2008, 10:00 am–1:00 pm*

Topic	Presenter	Time (min.s)
Introductory remarks	Neil Mullane, DEQ; Mike Gearheard, EPA; Conf. Tribes of the Umatilla Indian Reservation	10
Project Overview and Status • Why DEQ is reviewing the FCR • Process and current status • Factors affecting project timeline • October Action Item	Jennifer Wigal, DEQ	10
Summary of the Public Workshops	Mary Lou Soscia, EPA	5
Summary of the HHFG Report	Debra Sturdevant, DEQ; Pat Cirone, HHFG	15
The FCR in Context – How the FCR is used to calculate human health criteria	Debra Sturdevant	10
Why the 3 governments are "coalescing" around 175 g/d as a recommended FCR	CTUIR, Neil Mullane, Mike Gearheard	10
Fiscal Impact and Implementation • SAIC report • Overview of FIIAC work • Implementation approaches • FIIAC members' comments • Questions	Jennifer Wigal; Sarah Kruse, FIIAC co-chair; Willie Tiffany, League of Oregon Cities	15 10 10 15 10
Wrap up & next steps; projected rulemaking schedule	Jennifer Wigal	5
Panel of participants and stakeholders • Cheryle Kennedy, Chairwoman of the Grande Ronde Tribal Council • LLewellyn Matthews, Northwest Pulp & Paper Association • Written statement from Nina Bell, Northwest Environmental Advocates • Janet Gillaspie, Association of Clean Water Agencies		25

* There will be a 30 minute lunch break at approximately 11:30.

Human Health Focus Group Report on Fish Consumption

A Summary for the EQC

August 22, 2008
Debra Sturdevant, DEQ

State of Oregon
Department of
Environmental
Quality

Human Health Focus Group

Experts in toxicology, risk assessment and public health

Name	Affiliation
Pat Cirone, PhD	Retired Federal Scientist
Sue MacMillan	URS Corporation
Joan Rothlein, PhD	Oregon Health & Science University
Elaine Faustman, PhD	University of Washington
Ken Kauffman	Oregon Department of Human Services
Dave McBride	Washington State Department of Health

Questions Posed to HHFG

- What is the scientific evidence Oregon should rely on in selecting a fish consumption rate to use in setting State water quality standards?
- How should salmon be considered in selecting a fish consumption rate?
- To what extent are populations who consume more than 17.5 grams/day of fish at greater risk for health impacts?

HHFG Findings: Most reliable and relevant data

- Oregon - Columbia River Tribes:
  - CRITFC Fish Consumption Survey (1994);
- Washington - Puget Sound Tribes:
  - Tulalip and Squaxin Island Tribes Study (1996)
  - Suquamish Tribe Fish Consumption (2006)
- Washington - Asian and Pacific Islander
  - Seafood Consumption Study (1999)
- National - Total population:
  - EPA's Review of the CSFII (1998)

HHFG Findings

- 17.5 g/d does not reflect Oregon fish consumption
- The FCR should be based on fish consumers, not a per capita average
- A 90th or 95th percentile should be adopted to protect the population
- Current consumption may be suppressed

HHFG Findings: Salmon, Marine species

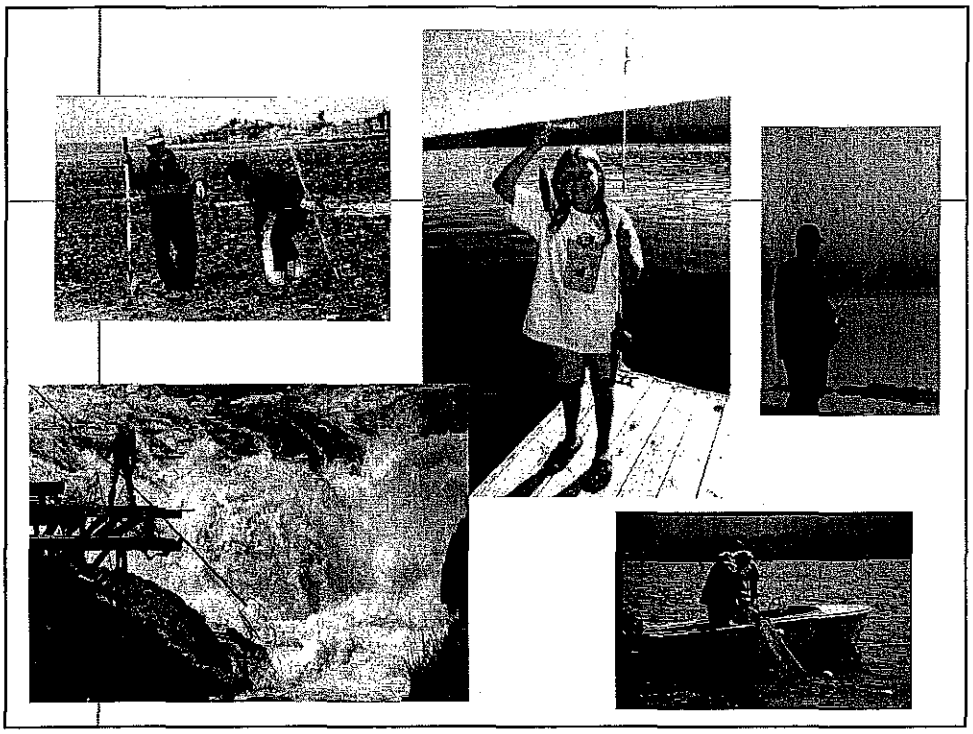
- Salmon should be included in the FCR
  - Primary fish choice for consumers
  - Route of exposure
- Looked at an alternative (relative source contribution), but did not feel that was sufficiently well developed at this time
- Marine species should be included
  - The studies don't differentiate near shore (Oregon waters) from open ocean species

HHFG Findings: Risk

- People who eat > 17.5 g/d are at an increased risk of heart, kidney or liver disease, neurological and developmental effects, cancer, and other health effects
- Some populations are more vulnerable, based on age, gender, health status

HHFG Range of FCRs (in g/d)

Group	Median	90th	95th
Columbia River Tribes	40	**113**	**176**
Tulalip Tribe	45	186	244
Squaxin Island Tribe	43	193	247
Suquamish Tribe	132	489	NA
Asians & Pacific Islanders	78	236	306
U.S. Population - Consumers only	99	248	334

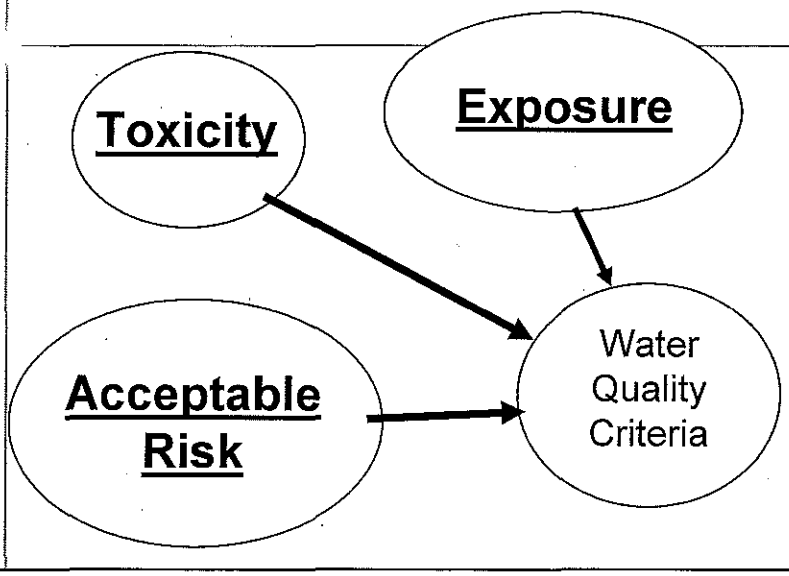


The FCR In Context

Setting toxic pollutants criteria to protect human health

DEQ
State of Oregon Department of Environmental Quality

Risk and Water Quality Criteria



Toxicity Factors used to Calculate Human Health Criteria

- Carcinogens (cancer causing):
  - Cancer slope factor
  - Acceptable risk: one additional incidence of cancer for every 1 million people (1:1,000,000)
- Non-carcinogens:
  - Reference dose – level below which not adverse health effects are expected to occur
  - Relative source contribution

Exposure Factors used to Calculate Human Health Criteria

- Body weight (average adult 70 kg, 154 lbs)
- Drinking water intake (2 liters/d, 90%ile)
- Fish consumption rate (grams/day)
- Bioconcentration factor

Relationship Between Fish Consumption and Criteria

- As consumption rate ⇧, criterion ⇩
- Magnitude of change is modified by the bioconcentration factor

⇧

Bioconcentration Factor

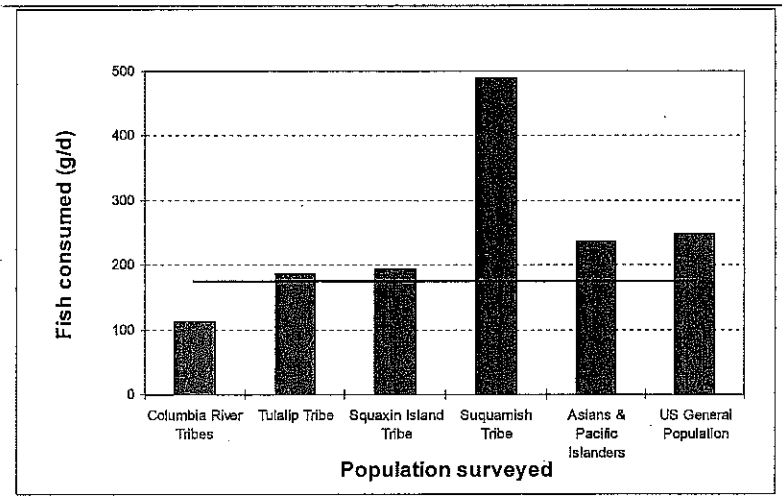
- How much a chemical tends to accumulate in organisms v. dissolve in water
- Varies by chemical
  - Range from 1 to 53,000+
- EPA provides national BCFs

In summary,

The fish consumption rate is an important, locally driven component of water quality criteria designed to protect human health.

The human health criteria are intended to protect people who eat fish and shellfish, whether that consumption is for health or economic reasons or based on a long cultural tradition.

Fish Consumption Surveys



Water Quality Program

State of Oregon Department of Environmental Quality

Cost of Compliance: SAIC Report

Jennifer Wigal

EQC August 22, 2008 – Information Item O

Informational Report on the Fish Consumption Rate Project

Water Quality Program

State of Oregon Department of Environmental Quality

Overview

- Analysis conducted by EPA-funded contractor, SAIC
- Charged with estimating the incremental cost of compliance to meet revised water quality criteria based on a new fish consumption rate
- Analysis contains
  - Estimates of costs for point sources
  - Qualitative description of potential costs for nonpoint sources and stormwater
  - Estimates of government regulatory costs associated with variances and an increase in the number of impaired waters
  - Discussion of uncertainties and limitations
  - Approaches and results of implementation activities and relevant actions in other states

State of Oregon Department of Environmental Quality

Approach to Estimating Costs

- Selection of facilities
  - Reviewed 1 minor steel mill and 4 largest facilities (municipalities, one of which is dominated by industrial wastewater)
  - Representative random sample of 15 additional facilities (both municipal and industrial)
- Cost estimated between criteria in effect and revised criteria based on a range of fish consumption rates
- Assumptions
  - Facilities with higher flows are most likely to incur the greatest costs
  - Facilities would pursue least cost approach to compliance

Water Quality Program

State of Oregon Department of Environmental Quality

Findings: Point Sources

- Reductions in effluent concentrations needed for at least 6 pollutants to achieve baseline water quality criteria
- Additional reduction efforts under revised criteria would also likely be needed for 3 of those pollutants
- Sources would likely use one or more compliance approaches to meet revised criteria:
  - Some treatment
  - Pollution prevention programs
  - Inflow and Infiltration controls (relevant for Arsenic)
  - Variances
  - Intake credits

State of Oregon Department of Environmental Quality

Findings: Estimated Annual Point Source Costs

- Baseline
  - $3.62 to $3.92 million (not including inflow & infiltration costs)
  - $3.62 to $29.7 million (includes I&I)
- Revised Criteria
  - $75,000 to $1.82 million,
    - Low end -- costs attributable to 63.2 gpd FCR, no I&I
    - High end – costs attributable to 389 gpd, including I&I
  - Facility actions to comply with baseline also results in compliance with the revised standards
  - Majority of the costs attributable to meeting baseline standards

Water Quality Program

State of Oregon Department of Environmental Quality

Findings: Nonpoint Sources and Stormwater

- Pollutants where point source controls insufficient to meet revised criteria
- Pollutants where ambient concentrations exceed criteria
- Potential sources include
  - agricultural and forest lands,
  - storm water,
  - legacy mining,
  - atmospheric deposition,
  - natural sources and
  - municipal and industrial point sources
- Costs highly uncertain; could be significant

State of Oregon Department of Environmental Quality

Findings: Government Regulatory Costs

- Report estimates government regulatory costs associated with
  - Additional waters listed as impaired and subsequent TMDL development
    - Estimated to be $26,000 to $500,000 per TMDL
  - Processing applications for variances
    - Estimated one-time incremental cost of $65,000 under existing regulations
  - Other government costs outside the scope of work

Water Quality Program

State of Oregon Department of Environmental Quality

Uncertainties in the Analysis

- Data limitations
  - Effluent data
  - Ambient data
  - Controls and activities underway
- Potential pollutant load reductions achievable
  - Method quantitation limits
- Dischargers' response to potential revised requirements and permit conditions

Overview of the Fiscal Impacts and Implementation Advisory Committee's (FIIAC) Work

A Presentation for the Environmental Quality Commission

Developed by FIIAC Co-Chairs:
Kristin Lee, ECONorthwest
Sarah Kruse, Ecotrust

What is FIIAC?

- Nine member advisory committee
- Names recommended to DEQ by variety of sources
- Representatives from tribes (2), public health (1), municipal water agencies (1), local government (1), industry (2), economic consulting firm (1) and economic innovation organization (1)
- Seven meetings to date, beginning January 29, 2008

Overview of FIIAC's Work

1. Review and comment on SAIC cost analysis
2. Listen to other cost analyses (from NWPPA and ACWA)
3. Discuss potential benefits
4. Discuss alternative implementation strategies
5. Note uncertainties and limitations
6. Provide conclusions and recommendations

SAIC Analysis

FIIAC members provided two rounds of comments on the SAIC analysis. Generally, these comments fell into the following categories:

- uncertainty about cost estimates;
- lack of thorough discussion of economic benefits;
- uncertainty/feasibility issues around variances and other non-traditional regulatory approaches in our region;
- the importance of distinguishing between baseline costs (at 17.5 gpd) versus the cost to comply with revised standards;
- lack of clarity/discrepancies in baseline information;
- uncertainty about sample representation; and
- lack of analysis on small business impacts.

SAIC Analysis

- Many of the comments submitted by FIIAC members were addressed by SAIC in the subsequent draft.
- The FIIAC plans to do a review of the most recent draft of the analysis but, due to extenuating circumstances, no consensus conclusions have been stated by the group at the time of this memo.

Other Cost Analyses

- Heard presentations of cost analyses by the Northwest Pulp and Paper Association and the Oregon Association of Clean Water Agencies
- FIIAC had opportunity to ask questions and discuss analyses, but no chance to review underlying assumptions or analyses of these studies
- FIIAC unable to make comparisons, conclusions or recommendations at this time

Cost Analyses

- SAIC assumed use of lowest cost approaches. Coupled with the lack of effective end-of-pipe controls for most of the issue contaminants, SAIC's approach largely involved toxics-reduction programs. SAIC also costed out end-of-pipe approaches, but didn't conclude that this would be the recommended approach.
- ACWA & NWPPA costed out ONLY end-of-pipe approaches—due to the current non-use of compliance strategies in Oregon other than end-of-pipe treatment.

Benefits

- DEQ did not have the time/funding for a benefits analysis
- That said, the FIIAC generally agreed that a fiscal impact analysis, by definition, should consider both costs and benefits
- The FIIAC also offers these thoughts on benefits:
  - Environmental protection entails both costs and benefits
  - Costs and benefits can be distributed across different groups and have varying levels of impacts on these groups
  - When either costs or benefits are "external" to the decision, the economic signals are distorted
  - Benefits would likely not be limited to fish consumers only

Benefits

- Because no analysis of benefits was done, the FIIAC created a table of *potential benefits* with the following caveats:
  - Point sources are likely a small component of all contaminant sources at a statewide scale
  - This is a list of categories of expected results for achieving water quality standards—and it is unknown what outcomes will actually result from this effort
  - This is not an exhaustive, definitive or predictive list
- Specific costs and benefits associated with alternative strategies were not analyzed either, but there was general consensus that some of these strategies may produce higher net benefits than end-of-pipe treatment alone

Answers to FIIAC Charge

The following bullets summarize responses to the questions specified in the FIIAC Charter, at the time of writing this memo:

- Would increasing the FCR have a fiscal and economic impact? **Yes**
- What is the extent of that fiscal and economic impact? **Uncertain, and, need to consider both costs and benefits.**
- Would increasing the FCR have a significant adverse impact on small businesses? **Not known at this time.**
- What is the extent of that fiscal and economic impact to small businesses? **More information needs to be gathered to answer this question.**

What FIIAC Can Say Today About a Revised Fish Consumption Rate:

- An increased FCR will have associated increased costs—especially with traditional approaches—the level of costs is dependent on the FCR and implementation strategies chosen
- It will take time for municipalities, industry and others to comply—the amount of time is likely to vary based on the FCR and the implementation strategies chosen
- Innovative approaches will be needed to attain the standard
- There will be benefits (but the level of those benefits have not been evaluated)
- A comprehensive approach is needed

Oregon Fish Consumption Rate Project

Fiscal Impacts and Implementation Advisory Committee
Memo to the Oregon Environmental Quality Commission

The purpose of this memo is to provide an overview of the convening and charge of the Fiscal Impacts and Implementation Advisory Committee (FIIAC), to summarize FIIAC discussions around costs, benefits and implementation ideas that were considered by the group, and to highlight conclusions and recommendations that culminated from this effort. Further details of the FIIAC information can be found in the Appendices that include the "FIIAC comments and response to comments on Science Applications International Corporation (SAIC) Cost of Compliance analysis" (Appendix 1) and FIIAC Meeting Summary Notes (Appendix 2).

I. OVERVIEW INFORMATION

Background

The Oregon Fish and Shellfish Consumption Rate Project, a joint project of Oregon Department of Environmental Quality (DEQ), United States Environmental Protection Agency (EPA) and the Confederated Tribes of the Umatilla Indian Reservation (CTUIR), has been evaluating options to revise Oregon's fish consumption rate, which is one variable used to calculate water quality criteria protective of human health. This effort is anticipated to end in late 2008 when the Environmental Quality Commission (EQC) chooses a fish consumption rate for rulemaking.

By October 2008, DEQ, EPA, and CTUIR plan to present a report to the EQC on a range of options to revise the fish consumption rate, with a goal of one joint recommendation from those options. That report will include a range of proposed implementation options to be considered in implementing a revised fish consumption rate.

Ideally, for the three governments to develop feasible implementation options, the economic effects (both costs and benefits) of each option need to be understood. To that end, DEQ, EPA and CTUIR convened the FIIAC as a group of interested experts who could help to develop feasible implementation options and also provide input on the impacts such options may have on a wide range of permitted dischargers, the public, and other stakeholders throughout the state. The expertise of the group ranged from backgrounds in economics, business administration, public works, public health, water quality, and engineering. A list of FIIAC members is shown in Table 1.

Table 1: FIIAC Membership

Name	*Affiliation*
Deanna Conners	Oregon Dept. of Human Services (Public Health Division)
Kathleen Feehan	Confederated Tribes of the Umatilla Indian Reservation (Tribe)
Rich Garber	Association of Oregon Industries (Industry)
Sarah Kruse	Ecotrust (Economic Innovation Organization)
Kristin Lee	ECONorthwest (Economic Consulting Firm)
Eric Scott*	Confederated Tribes of the Grand Ronde (Tribe)
Susie Smith	Association of Clean Water Agencies (Municipalities)
Willie Tiffany	League of Oregon Cities (Municipalities)

Kathryn VanNatta	Northwest Pulp and Paper Association (Industry)

* Eric participated in the first four FIIAC meetings and was not able to remain on the committee through the completion of the process. Therefore he did not provide input to this FIIAC memo.

Committee's Charge

FIIAC's final Charter specified the following four charges as the focus of the group's work together:

1. Consider and possibly contribute to the Implementation Strategies Inventory that will be compiled by DEQ and used in developing implementation options for potential new human health criteria.
2. Review and comment on the Draft Fiscal Impact Analysis in accordance with ORS 183.333. The analysis will be used to develop DEQ's Statement of Need and Fiscal and Economic Impact in anticipation of a future rulemaking to raise the FCR and lower human health water quality criteria. The FIIAC will address the following questions in their review:
   - Would increasing the FCR have a fiscal and economic impact?
   - What is the extent of that fiscal and economic impact?
   - Would increasing the FCR have a significant adverse impact on small businesses?
   - What is the extent of that fiscal and economic impact to small businesses?

   In addition, it is anticipated that members of this Committee will be able to provide information about the economic benefits of an increased fish consumption rate; information about economic or other benefits of an increased fish consumption rate will be provided to the EQC to help inform their final decision.
3. Discuss implementation options for multiple fish consumption rate scenarios
4. Provide any recommendations on fiscal impact and implementation strategies

(From *FIIAC Final Charter, 1-28-08*)

II. DISCUSSION OF FISCAL IMPACTS

a. Cost Analyses

As noted above, FIIAC was asked to review and comment on a fiscal impact analysis. To broaden the views, FIIAC looked at analyses that were generated from three different perspectives: federal/state, municipalities and industry.

EPA/DEQ Analysis: Science Applications International Corporation (SAIC), an independent firm, was contracted by EPA on behalf of DEQ to develop and perform a "Cost of Compliance with Water Quality Criteria or Toxic Pollutants for Oregon Waters" analysis. This cost analysis likely will be used to develop DEQ's Statement of Need and Fiscal and Economic Impact for any formal rulemaking that may result if the EQC decides to change the Fish Consumption Rate. EPA presented the analysis and revisions of the analysis to the FIIAC. In turn, FIIAC discussed the report and provided individual written comments to SAIC/DEQ/EPA (attached as Appendix 1). What follows is a brief summary of the highlights discussed at FIIAC meetings:

SAIC randomly selected seventeen facilities in Oregon for its analysis. The report identified baseline cost, changes that would be needed to meet new criteria, and drivers of cost. The methodology used was similar to that of the Great Lakes Initiative and work done in California.

The methodology involved: choosing random samples from an identified list of potentially affected facilities; pooling all available data; applying new criteria; and costing out the required changes to meet the new criteria. The criteria used for running the analysis included criteria associated with the baseline fish consumption rate (the current rate of 17.5 grams per day) and increased fish consumptions rates of 63.2, 113, 175, 389 and 620 grams per day.

SAIC evaluated the potential cost of compliance for point source facilities. To arrive at these estimates, they evaluated the four largest facilities (four municipal facilities, one of which is dominated by flow from a pulp and paper plant) and one minor industrial (steel mill). To evaluate the potential for costs at the remaining municipal and industrial facilities within the state, SAIC selected a representative random sample of 13 major facilities and two minor facilities. SAIC calculated costs for both total and incremental (i.e., above and beyond those needed for compliance with baseline standards) annual statewide costs, both with and without the costs for inflow and infiltration (I&I) controls to reduce arsenic in municipal sewer systems. SAIC also estimated costs for a range of revised FCRs (from 17.5-620 gpd). SAIC's approach to estimating costs assumed that facilities would pursue the lowest cost means of compliance with effluent limits. The means of compliance SAIC considering in calculating facilities' actions to come into compliance included:

- Optimizing treatment processes (e.g., adding chemicals to increase flocculation or filtration efficiency) to increase pollutant removal efficiencies;
- Source control (e.g., pollution prevention program, inflow and infiltration reductions, more stringent pretreatment standards);
- Installing end-of-pipe treatment technology; and
- Alternative compliance mechanisms (e.g., site-specific criterion, TMDL, or variance).

Uncertainties exist around actual use of some of the approaches included in the SAIC analysis. That said, while some of these approaches have not been commonly used in Oregon, SAIC assumed approaches were available where allowed by Oregon law.

SAIC estimated the annual costs to comply with baseline standards could range from $3.62 to $29.7 million dollars if I&I costs are included ($3.62 to $3.92 million if I&I costs are not included). In calculating the annual costs to comply with any newly proposed standards, SAIC estimated the total annual costs, statewide, would range from $75,000 to $1.82 million, with the low end representing costs attributable to revised standards based on a 63.2 gram per day fish consumption rate without I&I costs and the high end representing revised standards based on a fish consumption rate of 620 grams per day including costs associated with I&I. Because these costs are based on an extrapolation of costs estimated for the sample facilities, costs are not expressed on a per million gallon day basis, rather, they are expressed as a total statewide annual cost.

In evaluating the available data, SAIC concluded that reductions in effluent concentrations would be needed for at lease six pollutants to meet baseline criteria: 4,4'-DDT, alpha BHC, arsenic, bis(2-ethylhexyl) phthalate, dioxin, mercury. Additional reduction efforts under revised criteria would also likely be needed for three of those pollutants: Arsenic, bis(2-ethylhexyl) phthalate, mercury

In calculating these costs, SAIC found that many of the actions facilities would need to take to comply with the baseline standards would also result in compliance with the revised standards.

As a result, they found that the majority of the costs are associated with meeting the current, baseline standards. However, as noted above, they found there will be some additional costs associated with standards based on a higher fish consumption rate.

For some of the pollutants (e.g. mercury, arsenic) that SAIC concluded would most likely need additional reduction efforts, treatment technologies have not yet been proven to treat to those levels anywhere in the U.S. As a result, SAIC assumed that permittees would pursue alternative compliance mechanisms (e.g., variances) when permit limits are unable to be met. (It should be noted that these types of compliance tools are currently not in use in Oregon). SAIC estimates that one-time expenditures associated with variance applications could range from $1.43 million to $7.05 million (total statewide) under the baseline; incremental variance-related expenditures could range from $0.59 million to $2.68 million (total statewide) under revised criteria.

For additional information, SAIC included a summary of estimated costs for reverse osmosis, if that treatment were to be used at a facility. SAIC estimated the annual cost of reverse osmosis (capital plus O & M) to range from $7.1 million to $56.7 million per facility, depending on the wastewater treatment flows within the facility.

With regard to nonpoint sources and stormwater, the SAIC report provides some information regarding potential controls and associated unit costs, where available. For minor and indirect dischargers, the report notes that costs are highly uncertain based on limited or no data. The one exception to this conclusion is mercury due to its ubiquitous nature. The report notes that mercury is likely to be a pollutant of concern for minor municipal dischargers, and estimates that annual statewide compliance costs could range from $0.8 million to $3.9 million for revised mercury standards based on a 620 grams per day fish consumption rate.

For the report as a whole, SAIC noted several uncertainties in its analysis associated with data limitations, potential pollutant load reductions achievable, and how dischargers would respond to potential revised requirements and permit conditions. For the facilities analyzed, data were not available for all pollutants for all sample facilities, resulting in an inability to assess whether facilities were currently in compliance with the baseline standards. In addition, many of the revised criteria, regardless of the fish consumption rate used as the basis, are below method quantification level. As a result, there may not be measurable or quantifiable load reductions from point sources. As a result of these uncertainties, the estimated costs may be either higher or lower than those estimated by SAIC.

<u>FIIAC Member Comments on the SAIC Cost of Compliance Analysis</u>

FIIAC members provided two rounds of comments on the SAIC analysis. These comments were provided by individual members or their organizations. Generally, these comments fell into the following categories:

- uncertainty about cost estimates;
- lack of overall government costs and accurate wastewater treatment costs;
- lack of thorough discussion of economic benefits, including potential avoided costs;
- significant questions and issues regarding costs associated with inflow and infiltration (I&I) and pollution prevention (P2);
- uncertainty and feasibility issues around the reliance on variances and other non-traditional regulatory approaches in a litigious region: Oregon and EPA Region 10;

- additional costs identified by members that were missing from the analysis;
- the importance of distinguishing between baseline costs (at 17.5 gpd) versus cost to comply with revised standards;
- lack of clarity/discrepancies in baseline information;
- questions about how representative the facility samples were for Oregon;
- lack of analysis on small business impacts; and
- suggested revisions to data formatting.

Many of the comments submitted by FIIAC members were addressed by SAIC in the subsequent draft. FIIAC plans to do a review of the most recent draft of the analysis but, due to extenuating circumstances, including a delay in the release of the second draft, no consensus conclusions have been stated by the group at the time of this memo.

Industry Analysis: the Northwest Pulp and Paper Association (NWPPA) and the Association of Oregon Industries (AOI) representatives shared information with FIIAC from a CH2MHill cost analysis report that was developed beginning in 2006. This report found that, similar to the SAIC analysis, metals are a driver for detection and, therefore, cost. Mercury and arsenic, both of which can be naturally occurring elements, showed highest detection levels. The summary information shared with the FIIAC included effluent data at NWPPA sites and the estimated costs for end-of-pipe controls and removal technology methods that could be or are used to address them.

At the June 27 public workshop, NWPPA presented summary information from its second cost study done by HDR Inc. This study was based on a fish consumption rate range of 63-389 grams/day. NWPPA emphasized that (per DEQ's information) most point sources do not yet have permits incorporating the current criteria based on 17.5 grams/day. The HDR analysis studied various wastewater treatment options and the advantages and disadvantages to using each. Four mill effluents were used to analyze capital costs for each treatment technology based on 175 grams/day. For a mid-sized Oregon mill discharging 19 million gallons per day, iron coprecipitation was estimated at $25 million, nanofiltration was estimated at $67 million and reverse osmosis was estimated at $79 million. Annual operating and maintenance costs estimated for iron coprecipitation was $20 million, nanofiltration was $6.7 million and reverse osmosis was $7.4 million. Finally, annualized costs were estimated, over a 10-year period, for iron coprecipitation at $24 million, for nanofiltration at $16 million, and at $19 million for reverse osmosis. These estimated costs were compared to current yearly operation and maintenance costs for wastewater treatment, which were estimated to be approximately $3 million.

Municipalities' Analysis: The Association of Clean Water Agencies (ACWA) also shared summary information with FIIAC about the estimated costs to municipalities of implementing a higher fish consumption rate in Oregon. Again, metals and organic chemicals were of highest concern and, as a result, ACWA suggested that effective implementation and management should focus on pretreatment programs and pollution prevention.

ACWA estimated that capital costs for micro-filtration and reverse osmosis technologies to address metals would cost between $2.5 million and $3.5 million per million gallons per day, assuming some portion of the final effluent to be blended prior to discharge. Without blending, capital costs were estimated at about $6 million to $15 million per million gallons per day.

Based on these cost estimates, the ACWA information showed a combined capital cost range of $2.3-$3.3 billion for all of the four largest wastewater treatment systems in Oregon, including Portland, Clean Water Services, Eugene/Springfield and Corvallis. At the time of this memo, ACWA had committed to analyzing these broad costs to show what this would mean to ratepayers, and planned to provide that information to DEQ as soon as it is available. ACWA did note that operating costs to comply with an increased fish consumption rate would be significant, and those costs would include substantial energy consumption, chemical usage, ongoing operating and maintenance and disposal of briny sludges.

FIIAC Member Comments on the Industry and Municipalities Cost of Compliance Analyses
FIIAC heard presentations on the cost analyses noted above, but did not have the opportunity to analyze either of these analyses to the same extent that it reviewed the SAIC analysis. Summary information was shared and discussed at two FIIAC meetings and at the June 27 public workshop. Information about baseline assumptions, underlying data, calculations, or methodologies of these analyses were not made available nor were they a part of FIIAC discussions. As such, most FIIAC members noted that the industry and municipal cost analyses were not able to differentiate between the costs associated with current baseline criteria compliance as opposed to costs to comply with future criteria based on a potential increase in the fish consumption rate. It also was not possible to identify different costs associated with the different potential future fish consumption rates. As a result of this and time constraints related to this process, FIIAC was unable to reach any consensus conclusions about the analyses themselves or overall costs that will be associated with an increase in Oregon's fish consumption rate.

b. Benefits Discussions

As noted above, DEQ did not have the time or funding to research and do a quantitative analysis of the direct and indirect potential benefits of increased fish consumption rates. Because of this, members of the FIIAC worked together to provide initial information about the potential benefits of an increased fish consumption rate and also shared ideas for how DEQ could best reflect potential benefits within the time and fiscal constraints of this process (see attached "Potential Economic Benefits from an Increased Fish Consumption Rate".

FIIAC was provided with information from FIIAC members, the Oregon Environmental Council and DEQ relative to benefits. FIIAC members generally agreed that a fiscal impact assessment, by definition, should consider both costs and benefits. However, no specific consensus conclusions or recommendations related to benefits have come from FIIAC at this point. FIIAC members shared economic principles in FIIAC meetings, at the June 27 public workshop and shared here for the EQC:

- Environmental protection entails both costs and benefits and there are multiple ways that a healthy environment provides economic value.
- Costs may be easier to quantify than benefits, and benefits are equally important to understanding overall impacts.
- Costs and benefits can be distributed differently across public, business, and society at large and have different impacts on different groups.
- When either costs or benefits are "external" to the decision, the economic signals are distorted.

- Benefits from a revised FCR would likely not be limited to fish consumers only. A key outcome of a revised FCR that actually resulted in achieving more stringent water quality criteria would be a reduction in toxic contamination in waterways and an overall improvement in water quality.

Based on information shared with the group about economic benefits analysis, FIIAC members worked together to provide examples of the kinds of potential benefits that might result from setting a fish consumption rate and meeting water quality standards. The list of potential benefits was generated by the group and shared during the public workshop (see Table 2):

Table 2: Potential Benefits of Raising the Fish Consumption Rate and Meeting the Standards

Benefit	***Examples***
Human Health	Safe drinking water; avoided costs from environmentally attributable diseases; reduced risk for those who do eat fish; recreational – reduced risk from water contact
Environmental	Water reuse opportunities from cleaner effluent; business—cleaner intake water for downstream industries; ecosystem health; tourism; amenity/aesthetic/property values; avoided costs to industries and utilities; fewer contaminants; fishing – tribal, commercial, recreational and subsistence; improve other species in the food chain: birds, etc.; higher quality water supply
Cultural	Enable religious/ceremonial activities; children; healthy fish – icon of the Northwest and local, sustainable food options

Potential Benefits of Specific Implementation Strategies

Strategy	***Potential Benefits***
Toxic Reductions	Reduced human health impacts; innovative possibilities used to reach more efficient systems when not fearful of litigation stemming from strict liability regulatory framework; costs of litigation reduced; reduced O&M; reduced hazardous waste removal costs;

	reduced energy costs and associated emissions
Stormwater Control	Co-benefits for toxics reductions and control of other important stressors that affect fish health such as sedimentation and warm water temperatures
Infiltration and Inflow (I&I)*	Reduce quantity of water and toxics entering plant, reducing operating costs

(* It should be noted that ACWA agencies are already engaged in I&I programs and do not agree that an incremental increase in I&I will result in toxics reduction and question the efficacy of additional increases in I&I rehab work since 100% I&I removal is currently not possible.)

Given the discussions and input from FIIAC members, the following caveats relative to both lists of potential benefits are noted:

- point sources are likely a small component of all contaminant sources at a statewide scale;
- this is a list of categories of expected results for achieving water quality standards – and it is unknown what outcomes will actually result from this effort; and
- this is not an exhaustive, definitive or predictive list.

FIIAC heard from one of its members that, generally, an implementation strategy that achieves the same pollutant reduction at a lower cost may have higher net benefits and that some of the alternative approaches considered by FIIAC may produce additional benefits that are not yet known. The distribution of costs and benefits across affected stakeholders may differ across implementation strategies.

The FIIAC did not examine specific costs and benefits associated with any of the alternative strategies, but there was general consensus that some of the alternative implementation strategies may produce higher net benefits than end-of-pipe treatment alone. The amount and type of benefits depend on the extent to which a higher fish consumption rate actually reduces pollutant levels. Strategies that reduce pollutants more quickly, achieve more pollutant reductions and/or have a greater certainty of achieving reductions will have higher benefits. Finally, both benefits and costs need to be considered to best understand the overall economic effects of a revised fish consumption rate and for optimal economic outcomes to be achieved in Oregon.

c. General Comments about FIIAC Fiscal Impact Discussions and Areas for Future Refinements

This memo would not be complete without noting that funding from EPA supported the SAIC analysis of the estimated costs associated with changing Oregon's fish consumption rate. Costs for studies related to industry and municipalities were born by those entities. However, funds were not available to support an analysis of potential benefits associated with an increased fish consumption rate during this process. Instead, CTUIR and two FIIAC members provided assistance for researching studies on the economic benefits of water quality improvements and toxics reduction programs. FIIAC members themselves undertook the remainder of the analysis presented above. FIIAC's discussion of impacts to small businesses was limited by the fact that NWPPA and AOI were the only industry representatives at the table and there was neither time

nor data in this stage of the process for DEQ or others to do a more in-depth analysis of the potential economic impacts to other small businesses beyond ongoing outreach efforts. Several FIIAC members pointed out that small businesses that discharge to pretreatment systems under industrial user permits had not been fully quantified or identified, nor had they been included in the SAIC, NWPPA or ACWA cost reports--in discussion or analysis. That said, DEQ committed to continue outreach efforts to other potentially affected industry interests, and expects more engagement to occur after an EQC decision is made on this issue, especially if DEQ begins its rulemaking process in 2009.

III. DISCUSSION OF IMPLEMENTATION STRATEGIES

At the request of DEQ, EPA and CTUIR, the FIIAC developed and refined a list of potential compliance implementation strategies in an Implementation Matrix over the course of several FIIAC meetings (see attached "Implementation Matrix"). The matrix includes a series of possible implementation approaches and some of the potential advantages, disadvantages, relative costs, regulatory status and outcomes associated with them. Most FIIAC members agreed that the matrix should be viewed as a fairly comprehensive list of ideas that DEQ should consider now and in the future in order to implement a new fish consumption rate. Some members felt strongly that regulatory certainty and legal assurances must be provided by DEQ and EPA in order for the 'non-traditional' options to be considered viable prior to moving forward with implementation of a revised fish consumption rate. While most FIIAC members agreed it is important to be realistic about the feasibility of implementing new approaches in the near term (i.e. three to five years), due to legal uncertainties and uncertainties about funding to support new measures, they also suggested that *all* potential ideas should be put forth for further examination and perhaps future use.

From the matrix, the FIIAC began to formulate ideas around options that lead to a 'comprehensive approach to toxics reduction'. Some members felt that the primary focus of such an option should be on the major human health based contaminants of concern, and then move on to Reasonable Potential Analysis problems in individual permits. Toxics reduction options might include several of the individual approaches listed in the matrix. FIIAC members agreed that, to take a comprehensive approach, a compliance schedule will likely be needed in order to move into the other regulatory compliance tools under the Clean Water Act. Some FIIAC members noted that none of the regulatory compliance tools are currently being used in Oregon permits although they may be in use in other parts of the country. Some FIIAC members also shared the hope that compliance schedules *will* be used as a tool in the future, and suggest that a decision is needed soon about the feasibility of using this tool in Oregon: to be a realistic tool, any such decision should be properly documented to provide credibility and certainty to potential users of the tool. It should be noted that some FIIAC members expressed concern that moving forward without legal assurances for the creative tools and options included in the matrix would have unknown and worrisome consequences for permittees.

FIIAC explored the broader matrix via a "Path to Compliance Matrix." Three alternative pathways to compliance were discussed:

1) Technology-based advanced treatment to meet effluent limits based on the revised standards. Compliance schedules would be needed, as well as "pass-through" credits (also known as intake credits) and variances.

2) A toxics reduction program plus 'best conventional treatment.' Compliance schedules would be used, coupled with a toxics reduction program and best conventional treatment in the first permit cycle. Then, if met, continue with a compliance schedule or, if not met, consider additional pollution prevention and or reduction approaches, look at other tools such as variances, use attainability analyses (UAA), pass-through credit, and/or offsets/trading.
3) Use of a water quality benchmark in the first permit cycle. The objective for this would be to provide less legal liability for the permittee than using a numeric limit in the permit. The same tools might be used for the first permit cycle, then the second cycle could use a compliance schedule, variance, pass through credits, UAA and/or offsets/trading.

FIIAC members were leaning towards the second approach, yet some members noted that the details of the approach still need to be fleshed out before they are comfortable supporting it. Those who had concerns noted that permit holders must comply with the Clean Water Act. The current strict liability emphasis of statutes in Oregon requires end-of pipe treatment and, without regulatory off-ramps, permit holders will be required to install yet unproven treatment technology. Yet, in general, the FIIAC had concerns about relying solely on current end-of-pipe treatment technologies to achieve effluent limits (first approach), due to feasibility issues. Some FIIAC members were interested in the benchmark approach for the first permit cycle as it is similar to the mechanism that has been used in the stormwater permitting program, and it would provide permittees the time and opportunities to determine what technologies and programs will and won't work to achieve compliance. Other FIIAC members expressed concerns about setting a benchmark rather than a numeric effluent limitation based on water quality standards in the third approach as it reduces the enforcement mechanisms that would otherwise be available. Additional options proposed for consideration by NWPPA and AOI are included on page 3 of the Implementation Matrix: D*e minimus* and Bifurcated criteria. To aid understanding of the above approaches, DEQ developed a flow chart that demonstrates how a permittee might apply some of the suggested compliance strategies (see attached "DEQ Implementation Flow Chart".

The Implementation Matrix provides analysis of the technical, legal, political and economic feasibility of the various implementation options. Some FIIAC members felt these concerns will need to be addressed prior to the option being employed by DEQ.

IV. BRIEF SUMMARY OF ANSWERS TO FIIAC CHARTER QUESTIONS

The following bullets summarize responses to the questions specified in the FIIAC Charter, at the time of writing this memo:

- Would increasing the FCR have a fiscal and economic impact? **Yes**
- What is the extent of that fiscal and economic impact? **Uncertain, and, need to consider both costs and benefits.**
- Would increasing the FCR have a significant adverse impact on small businesses? **Not known at this time.**
- What is the extent of that fiscal and economic impact to small businesses? **More information needs to be gathered to answer this question.**

V. CONCLUSIONS AND RECOMMENDATIONS

At this time, the FIIAC has reached no consensus on the anticipated costs or benefits of a revised FCR. A broad range of information was shared with the FIIAC over the course of six months of work together that led the group to draw some general conclusions. The degree of uncertainties and limitations such as varying perspectives on the assumptions imbedded in each of the cost analyses, lack of funds to support a comprehensive benefits analysis, and a lack of cost and benefits analysis for the specific and various alternative implementation strategies the group discussed, affected the FIIAC's ability to draw strong conclusions or provide consensus recommendations to the EQC at this time.

Still, there are some statements the FIIAC can make for the EQC to contemplate when considering whether or not to increase Oregon's fish consumption rate:

- It will take time for municipalities, industry and others to comply with water quality standards that would result from a higher fish consumption rate, and the amount of time needed is likely to vary based on the FCR and implementation strategy chosen.
- Based on the cost analyses provided for this effort, a higher fish consumption rate and resulting water quality criteria will have increased costs associated with it. This is especially true if permit holders are limited to installing end-of pipe treatment technology to meet more stringent water quality standards The level of costs depends on the implementation strategies available.
- Benefits will be accrued from meeting a water quality standard (and the level of those benefits depends on the degree to which pollution reduction is achieved).
- Traditional technology treatments that would be needed to meet more stringent water quality standards if only an end-of-pipe approach is used have not yet been proven to be effective. Therefore, innovative regulatory approaches, beyond installing end-of-pipe treatment technologies, are needed to help attain the standard. Because many of the tools that might be utilized to implement an innovative regulatory approach have never been used in Oregon, it is hoped that a decision to allow appropriate use of compliance schedules is made soon.
- The state should set an approvable standard that protects all fish consumers in Oregon, and the implementation approach to achieve that standard should be:
    - innovative;
    - comprehensive;
    - able to be implemented;
    - cost effective;
    - integrated across point-source and non-point source boundaries; and
    - provide for reasonable legal assurances/safety net.
- The broader state-wide focus to achieve good water quality should be on pollution prevention and toxics reduction measures.

This memo is respectfully submitted to the EQC by DS Consulting on behalf of the Fiscal Impacts and Implementation Advisory Committee
August 13, 2008.

POTENTIAL ECONOMIC BENEFITS FROM AN INCREASED FISH CONSUMPTION RATE

A Working Discussion Piece Prepared in Support of the FIIAC[1]

June 2008

The economic evaluation of environmental regulation is frequently narrowly focused on the costs of proposed rules to the regulated community. While these costs may be significant, the FIIAC believes that it is equally important to understand that environmental regulation frequently results in benefits. These benefits are often overlooked in the economic analysis portion of rulemaking processes.

This paper will qualitatively discuss the potential economic benefits that may result from an increased fish consumption rate. Where available, the discussion will use local data demonstrating economic benefits from increased pollution control (a direct result of increasing the fish consumption rate). In some situations, non-local data is used merely to illustrate potential benefits that could be realized in Oregon from increased water quality. This paper is not intended to posit that a certain dollar amount of benefits will accrue in Oregon, but rather, is meant to be read in light of the discussion of potential costs of an increased fish consumption rate, and show that while there will be likely costs associated with an increased fish consumption rate, there will also be likely benefits.

Human Health Benefits

Any reduction in the total toxic load in Oregon waterbodies is likely to have a positive effect on the human health of Oregonians. This will translate into an as yet unknown economic benefit through avoided costs. A recent study by the Oregon Environmental Council determined that environmentally attributable diseases, like cancer, birth defects, and neurobehavioral problems, and the direct and indirect costs of treating and caring for people afflicted by these diseases costs Oregonians at least $1.57 billion annually.[2] This cost only represents the fraction of the cost of treating and caring for persons with diseases that can be reasonably attributed to environmental contaminants, meaning they are conservative estimates. While some of the diseases in the report, and thereby the costs, do not arise from water or fish borne toxics, the report highlights that "policy, and in particular, environmental health policy, fails to fully consider the environmentally attributable economic costs of diseases and disabilities."

While the Price of Pollution study only briefly discussed specific causes of environmentally attributable diseases, other studies have highlighted the human health risk posed by the consumption of fish. The following table, drawn from the Lower Columbia River Bi-State Program's 1996 Human Health Risk Assessment, shows the cancer risk posed by the consumption of fish from the Columbia River[3]:

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[1] Prepared by Ryan Sudbury, Confederated Tribes of the Umatilla Indian Reservation

[2] Oregon Environmental Council, *The Price of Pollution*, 2008. Pg. iii.

[3] Tetra Tech. *Assessing Human Health Risks from Chemically Contaminated Fish in the Lower Columbia River*, 1996. Pg 5-5 (assumes a 70 year exposure timeframe).

	Chinook	Carp	Sucker	Sturgeon	Steelhead
6.5 g/day	18 cancers in 1,000,000 exposures	160 cancers in 1,000,000 exposures	37 cancers in 1,000,000 exposures	54 cancers in 1,000,000 exposures	5.6 cancers in 1,000,000 exposures
54 g/day	150 cancers in 1,000,000 exposures	1,300 cancers in 1,000,000 exposures	300 cancers in 1,000,000 exposures	450 cancers in 1,000,000 exposures	46 cancers in 1,000,000 exposures
176 g/day	490 cancers in 1,000,000 exposures	4,400 cancers in 1,000,000 exposures	1,000 cancer in 1,000,000 exposures	1,400 cancers in 1,000,000 exposures	150 cancers in 1,000,000 exposures
The Oregon DEQ target for potential cancer risk is 1 excess cancer in 1,000,000 exposures.					

Salmonids and resident fish showed similar patterns of potential risk from noncarcinogenic health threats, such as developmental and central nervous system impairments. Reducing toxics in Oregon's water and fish will reduce the costs associated with treatment and care of environmentally attributable diseases, and will result in a positive economic benefit to Oregonians.

Oregonians may receive additional economic benefits in terms of reduced health care costs due to consumption of greater amounts of fish, in place of other meat sources. For those who eat fish for the health benefits, the increased abundance of healthy local fish may also reduce costs associated with the purchase of fish from more remote locations (i.e. Alaska, etc.), resulting in an economic benefit for the consumer.

Salmon Restoration Benefits (and Reduced Costs)

Recovery of threatened and endangered salmon and steelhead costs Oregon hundreds of millions of dollars a year. The costs are incurred because of increased regulation; higher electricity prices; expense of public funds for recovery and mitigation programs; etc... A portion of this expense is related to toxic contamination in Oregon's waterways. A recent report released by the Lower Columbia River Estuary Partnership found that by some estimates, exposure to toxic contaminants causes delayed, disease-induced mortality of up to almost ten percent of all the juvenile Chinook salmon that move through the estuary.[4] This figure does not include the mortality caused by failure to avoid predators as a result of toxic exposure, which if included, would increase the mortality rate. The toxics issue is of such great importance that NOAA Fisheries ranks the need to address toxic contaminants in the top seven of twenty-two suggested actions to improve juvenile salmonid survival in the lower Columbia River.[5]

The reduction of toxics in Oregon's waters may not only reduce the costs associated with salmon recovery, but it may also increase the economic benefit derived from recreational and commercial fishing. A report released in 2005 concluded that restored salmon and steelhead

[4] *Lower Columbia River Estuary Partnership, Lower Columbia River and Estuary Ecosystem Monitoring: Water Quality and Sampling Report. 2007.*
[5] *Ibid.*

fisheries would result in $544,000,000 of annual economic benefits to the state of Idaho alone.[6] Economic benefits to Oregon and Washington may be similar, if not higher, based on a higher population of fish and people in the lower Columbia River Basin.

Recreational and Aesthetic Benefits

Reduced toxics in Oregon's waterways will likely increase recreational fishing and tourism to swimming and fishing locations throughout the state. Healthy, clean fish may help- restore fish as an icon of the northwest, and increase tourism to the region. Additionally, cleaner rivers and fish may lead to increased birding and wildlife viewing opportunities, as the benefits of cleaner fish work themselves up the food chain, resulting in substantial economic benefits.

While these statewide values are difficult to calculate or predict, a study of the Willamette basin found considerable recreational and aesthetic economic benefits resulting from water quality improvements as a result of point source pollution controls[7]. The study found that for the time period between 1972 and 1992, point source pollution controls resulted in between $275 million and $594 million worth of annual recreational and aesthetic economic benefits for the Willamette basin.[8] The study defined recreational and aesthetic uses as including recreational fishing, swimming, wildlife viewing, and general aesthetic benefits (using a Willingness to Pay for protection theory).These numbers indicate that cleaner water (and by connection, cleaner fish and wildlife) results in significant economic benefits for Oregon and its citizens.

Property Values Benefits Associated with Less Toxic Water Bodies

A reduction in toxics found in Oregon waterways may lead to increased property values for properties located near rivers or lakes. A recent study from the Great Lakes region estimated that property values were significantly depressed in two regions associated with toxic contaminants (PAHs, PCBs, and heavy metals). The study showed that a portion of the Buffalo River region (approx. 6 miles long) had depressed property values of between $83 million and $118 million for single-family homes, and between $57 million and $80 million for multi-family homes as a result of toxic sediments. The same study estimated that a portion of the Sheboygan River (approx. 14 miles long) had depressed property values of between $80 million and $120 million as the result of toxics.[9] While this study related to the economic effect of contaminated sediment, the idea that toxic pollution depresses property values is easily transferable to Oregon. A reduction in toxic pollution in Oregon waters may have a substantial economic benefit to property values in close proximity to Oregon waterways, and also result in additional property tax revenues to pay for state programs.

Benefits and Reduced Costs of Cleaner Drinking Water

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[6] Ben Johnson & Associates, *The Potential Economic Impact of Restored Salmon and Steelhead Fishing in Idaho*. 2005.

[7] Environmental Protection Agency, *A Benefits Assessment of Water Pollution Control Programs Since 1972*, Part I, EPA-EE-0429 (2000). Pg. 6-15–6-29.

[8] *Ibid.*

[9] *Economic Benefits of Sediment Remediation*, <http://www.nemw.org/Econ%20Ben%20Report06%20braden.pdf> (last accessed June 20th, 2008).

Much of Oregon's drinking water comes from surface water sources. The Willamette Basin had ninety-four million gallons of drinking water withdrawals in 1990 alone.[10] Oregon's drinking water stands to become cleaner as a result of an increased fish consumption rate and the associated stricter water quality standards. There are numerous economic benefits and averted costs associated with cleaner drinking water. Water suppliers may benefit from lower pretreatment costs and averted costs from needing to obtain water from headwaters sources. There are also the avoided costs of aversion behaviors, such as buying household pretreatment/water filtration systems, and bottled water, which costs between 240 and 1,000 times as much as tap water[11] and the containers need to be recycled or disposed of in landfills. Reduced toxics in Oregon's waters may result in real economic benefits in terms of reduced household and producer expenses.

Reduced Costs to Downstream Surface Water Users

Fewer toxics in the river may reduce costs incurred by downstream surface water users, who have to pre-treat water for industrial or commercial use (i.e. food processors). Additionally, reduced toxics in the water column may also reduce costs associated with end-of-pipe treatment for downstream water users, as they will not need to remove toxics present at the intake source.

Benefits from Potential Implementation Strategies

The FIIAC is discussing alternative avenues to address implementation issues associated with an increased fish consumption rate. Some of the non-traditional implementation strategies would have associated economic benefits. Off-site toxic mitigation programs, in place of additional end-of-pipe treatment, would cleanup legacy toxics, thereby increasing the magnitude of the potential economic benefits discussed above. Increased stormwater controls to reduce the inflow of toxics into surface waters may result in economic benefits related reduced erosion and sedimentation of waterways, and increased fish health and abundance from reduced stormwater pollution and stream temperature (i.e. reduced water runoff from hot pavement).

Conclusion

While economic benefits of environmental regulation are sometimes difficult to quantify, the FIIAC believes it is important to acknowledge that such benefits are likely to be realized given an increased fish consumption rate, and as such deserve equal consideration in the decision-making process. Decreased health care costs, increased property values, additional recreational and commercial fishing opportunities, and cleaner drinking water, among others, are all potential benefits that may result from an increased fish consumption rate and, therefore, these potential economic benefits should be considered during any economic analysis of an increased fish consumption rate.

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[10] Environmental Protection Agency, *A Benefits Assessment of Water Pollution Control Programs Since 1972*, Part I, EPA-EE-0429 (2000). Pg. 6-14.

[11] *The Real Costs of Bottled Water*, San Francisco Chronicle, Feb. 18th, 2007, < http://www.sfgate.com/cgi-bin/article.cgi?f=/c/a/2007/02/18/EDG56N6OA41.DTL> (last accessed June 21st, 2008).

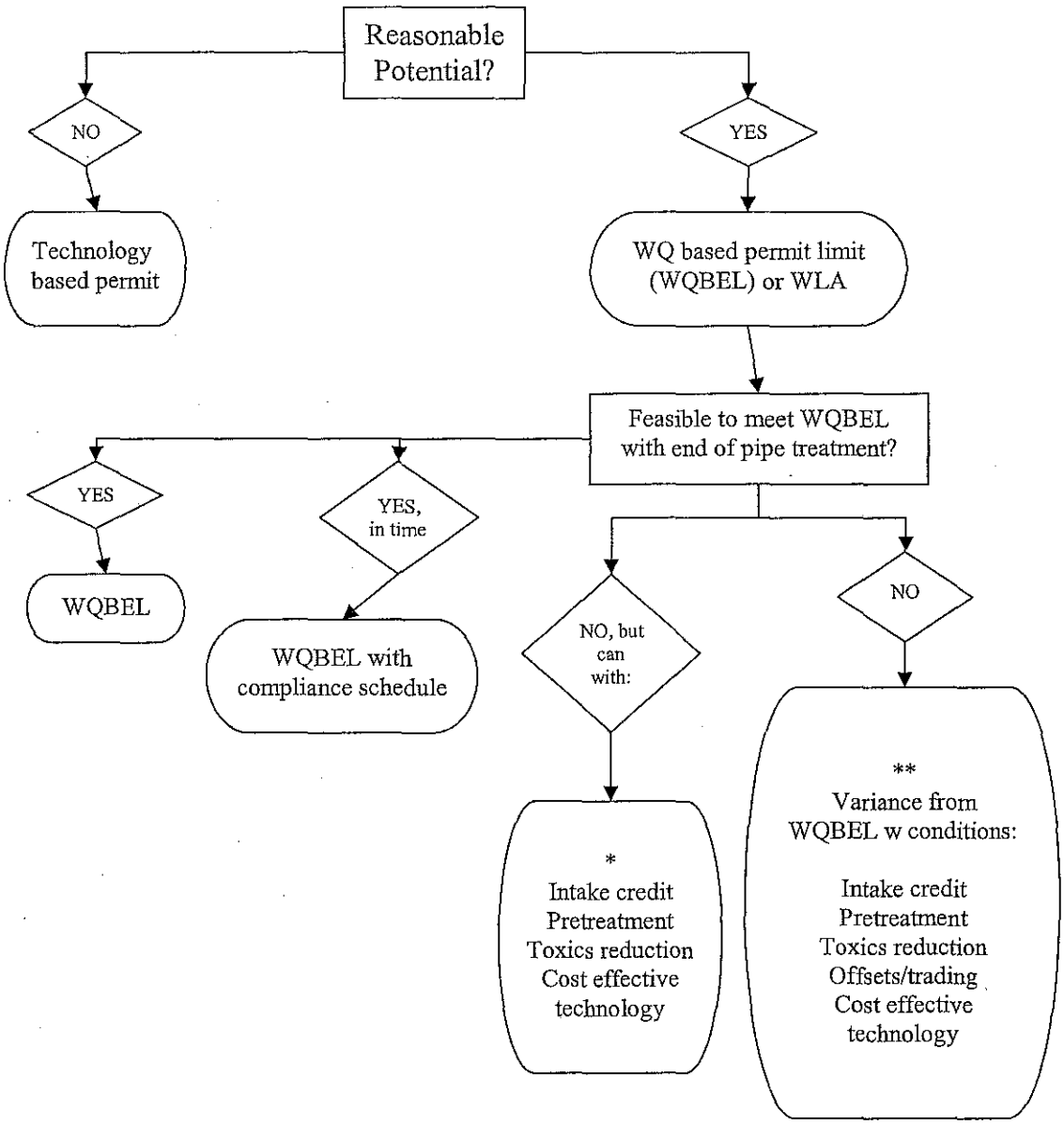


Figure 1. Implementation framework for permitted point sources that have a reasonable potential to exceed the applicable criteria.

*Quantitative analysis will be needed to show attainment with the WQBEL. A compliance schedule may be needed.
**Variances could be done for individual sources or multiple sources in similar circumstances.
Note: The measures in these boxes be used in combinations.

Measures that involve modifying the applicable criteria include:

- Site specific criteria, i.e. based on natural background levels or other site specific conditions (criteria must protect designated use).
- Beneficial use revision or removal/UAA. (For example, are there some water bodies that should not be designated as drinking water sources.)

Fish Consumption Rate Process-- Draft Implementation Alternatives Matrix

Option Name	Approach	Regulatory or Voluntary?	Chemical Driver	Affected party	Regulatory Certainty	Used in Oregon?	Used in U.S.?	Impl. Steps/schedule	Monitoring Plan	Compliance Enforcement Mechanism	Costs				Benefits	Expected Results	Feasibility			
											Capital	O&M	Pollution	To Regulated Comm.			Tech	Legal	Political	Economic
Compliance schedules	**General Approach:** Use of schedules of compliance where immediate compliance with water quality-based effluent limitation can not be achieved	Regulatory; authorization usually contained in State WQS and implemented through permitting process	All	Permittees	Certain	Yes, temporarily on hold due to litigation	Yes, commonly	Must show that immediate compliance not possible; interim milestones must be identified leading to reasonable further progress; permit must contain final enforceable limits	Could be included						Water quality based-effluent limits will ultimately be attained; legal mechanism contained in permit.	Appropriate in circumstances where compliance with water quality-based effluent limits is ultimately expected, with some certainty		Unknown: Currently being litigated on related issue		
	Phosphorous in Oklahoma: Set more stringent phosphorous criterion, received resistance from Arkansas, decided to phase-in criterion through compliance schedule language with objective of meeting criterion within 10 years (2012).	Regulatory; authorization and some schedules contained in State WQS; implemented through permitting process	Phosphorous	Dischargers in Oklahoma and Arkansas	Certain	No	Being tried in this example	Schedules established for large cities to meet interim limits; Medium sized entities (0.5 MGD-1 MGD req'd to reduce P to the maximum extent possible through voluntary controls aimed at reaching interim limit or P loading limited based on flow and effluent concentration.		Compliance schedule					Continued progress toward meeting WQS while actions in addition to point source reductions are being pursued.			Yes		
Variances	**General Approach:** Where analyses demonstration dischargers cannot meet WQS based on 1 of the 6 bases contained in the regulations (most likely reasons include "widespread social and economic impact" or naturally occurring pollutant concentrations," dischargers may get a variance	Regulatory; contained in State WQS; burden of proof on user	All	Permittees	Limited certainty	No	Yes, not new or uncommon	Applicant must show that cannot meet water quality-based effluent limits; may include terms and conditions during term of variance; 1 every 3-5 years variance must be renewed to assure conditions under which variance granted still exist	Could be included	EQC decision requiring EPA approval			Limit unknown	Applicant bears burden of proof for variance	Progress toward reductions may occur			Yes	Requires EQC and EPA approval	
	Mercury in the Great Lakes States: Statewide variance procedures in Michigan, Ohio, Wisconsin with typical POTW types and limits.	Regulatory	Mercury	POTWs	Certain - depends on type of POTW	No	Yes	Must meet minimum effluent quality; submit information indicating no readily available end-of-pipe treatment technology; development and implementation of pollutant minimization program	Yes						Continued reductions in mercury; cost-effective source reduction activities			Yes (current legal challenge in one state)		
Uses and Variances	**PCBs in Delaware Estuary:** Approach still being formulated--under consideration are 10 year incremental waterbody WQS implementation plans for PCBs (like a variance). Criterion is not attainable and not expected to be for decades. Fish consumption use was replaced with Restoration Use. Permittees would have narrative effluent limit requirements based on Restoration Use.	Regulatory	Historical PCBs in sediment	Permittees; other sources of PCBs	Objective is for regulatory certainty, unknown at this time	No	Just in this case	10 year incremental plans to reduce PCBs	Monitor to report every 10 years on PCB reduction	If plans are found to be ineffective, EPA will not renew the plan					Minimize historical levels of PCB contamination					

Option Name	Approach	Regulatory or Voluntary?	Chemical Driver	Affected party	Regulatory Certainty	Used in Oregon?	Used in U.S.?	Impl. Steps/schedule	Monitoring Plan	Compliance Enforcement Mechanism	Costs				Benefits	Expected Results	Feasibility			
											Capital	O&M	Pollution	To Regulated Comm.			Tech	Legal	Political	Economic
Offsets	**Generic Description:** New or expanding sources seek more cost-effective reductions in the same pollutant elsewhere in the waterbody/watershed to allow additional increased mass loadings of a pollutant	Regulatory		Permittees; other sources of the same pollutant		Yes, as trading	Unsure how widespread									Overall reductions in water body				
Intake credits	**Great Lakes Approach:** Where intake water exceeds the water quality criteria, water quality-based effluent limitations are set equal to the mass and concentration of the intake water.	Regulatory	Pollutants where high levels are found in intake water	Permittees	Certain	No, but concept under development	Yes	Sufficient information to characterize intake water	Must monitor to assure compliance with limits						Not required to treat pollutants that are not part of facilities processes.		Yes	Federally, Yes; may need additional work in Oregon		Yes
Phased implementation	**Mercury Reduction in Minnesota:** New fish tissue based Hg criterion will only be used initially for human health, but could be used to set effluent limits in the future	Regulatory	Mercury reduction		Uncertain	No	This is only known example	Wait for EPA to finalize Hg implementation guidance							Adequately protective Hg criterion					
SSC based on natural conditions	**Generic Approach:** Adopt SSC for water body that can not attain criteria due to natural conditions (i.e. geologic sources of arsenic)	regulatory	most likely arsenic			Oregon has natural background criterion, hasn't adopted SSC	Yes	Rulemaking to set SSC for specific water body based on natural background levels										Yes		
UAA	**Generic Approach:** Revise designated use for water body that can not attain criteria due to natural conditions	regulatory	most likely arsenic			No, but have developed IMD	Yes	Rulemaking										Yes		
Toxics Reduction Approach	Alternative toxics reduction approach based on reasonable potential analysis along with integrated statewide toxics reduction implementation.	Both, regulatory to meet the needs of the Clean Water Act.	To be determined. Should be focused on priority pollutants.	All Oregonians: Citizens; Industries; Agriculture; Forestry; Consumers; Government; Legacy Site Owners	Certainty for point sources would have to be verified through EPA approved process. For other sources some would be certain, some uncertain.			NPDES permit requirements. SB 1010 plan requirements. Forest practices act requirements. Other toxic requirement tools.	NPDES monitoring requirements. DEQ toxics monitoring. Other regulatory monitoring.	NPDES, SB 1010, Forest Practices, Toxic Substances Control Act, Title V, other enforcement mechanisms.	Potentially low for elements of a toxics reduction plan. Legacy source controls potentially high.	Program costs are probably most significant for toxic reduction programs.	Unknown what this category addresses	Implementation could cost local businesses, consumers, farmers and industries.	Eliminate toxics from entering the waste stream. Achieving toxics reductions outside the Clean Water Act regulatory scheme	Improved water quality, human health benefits	Legacy sources maybe most other activities likely low technologies requirements. So yes.	Requires EPA sign approval and endorsement. Statutory changes may be required for non-point sources.	Requires major local political support. Statutory changes require state political support.	In most cases this option is economically viable.
Traditional Treatment Approach	Microfiltration followed by Reverse Osmosis--w/blending	Regulatory: technology and or numeric based	All metals and toxics that are not removed through conventional treatment	Point sources and POTWs	Depending on the numeric limits, this could be difficult given that levels may be below detection			POTWs would have to revamp facilities plans, process, CIPs, financing and rates--would require compliance schedules to achieve	Would be part of NPDES permit and DMRs	NPDES permits; CWA provisions	$2.5m to $3.5 m per mgd=$2.3 billion to $3.27 billion for Corvallis, MWMC, CWS, & Portland	Significantly increased electrical and chemical and sludge disposal costs	Increased pollution & green house effect from energy consumed; additional chemical	All costs would be born by rate payers	Known technology increases treatment levels	1)Large amount of money spent with little incremental improvement--not a cost-effective way to treat the problem. 2)Wide spread non-compliance from inability to fund multibillion $ program, while sources left unchecked.	variable with some unknowns	meets CWA objectives	low	low

Option Name	Approach	Regulatory or Voluntary?	Chemical Driver	Affected party	Regulatory Certainty	Used in Oregon?	Used in U.S.?	Impl. Steps/schedule	Monitoring Plan	Compliance Enforcement Mechanism	Costs				Benefits	Expected Results	Feasibility			
											Capital	O&M	Pollution	To Regulated Comm.			Tech	Legal	Political	Economic
Traditional Treatment Approach	Microfiltration followed by Reverse Osmosis--full treatment	Regulatory: technology and or numeric based	All metals and toxics that are not removed through conventional treatment	Point sources and POTWs	Depending on the numeric limits, this could be difficult given that levels may be below detection	No, with regard to the specific treatment specified	No, with regard to the specific treatment specified	POTWs would have to revamp facilities plans, process, CIPs, financing and rates--would require compliance schedules to achieve	Would be part of NPDES permit and DMRs	NPDES permits; CWA provisions	$6 m to $15 m per mgd=$5.6 10 billion to $14.025 billion (for same POTWS)	Significantly increased electrical and chemical and sludge disposal costs	Increased pollution & green house effect from energy consumed; additional chemical	All costs would be born by rate payers		1)Large amount of money spent with little incremental improvement--not a cost-effective way to treat the problem. 2)Wide spread non-compliance from inability to fund multibillion $ program, while sources left unchecked.	variable with some unknowns	meets CWA objectives	low	low
Pass-through Allowance (Variation of "Intake Credits")	**General Approach:** Mass (lb/day) allowance/credit granted based on concentration x flow for human health pollutant of concern, natural or background, brought in via intake water.	Regulatory	HH WQ Criteria below feasible quantitation or removal by FCR increase	Point sources and POTWs	Fits with additional implementation tools	No	Yes, as intake credit	Permittee required to submit valid sampling, flow and mass calculation data for water intake and effluent	Required for NPDES application renewal or by compliance schedule	NPDES permits, Industrial User permits				Sampling, Flow and Engineering Costs by permittees~est. $10k-$25k depending on complexity	Equitable, permittee not unfairly penalized for naturally occurring or background COC's.	Potential for practical, meaningful tool	high	Verify if used in some states. Not currently used in Oregon		high
WQ Benchmark Criteria	**General Approach:** Revised FCR used to establish HH Toxics Benchmarks. Benchmarks used to establish WQ permit goals. Implementation requirements follow a "top down" evaluation that looks at enhanced sampling, feasible technology, toxics use reduction and pollution prevention evaluation and implementation.	Regulatory	HH WQ Criteria below feasible quantitation or removal by FCR increase	Point sources, POTWs, Non-point Sources	Discuss	Analagous to Chl-a action level?	As described--no	Implementation requirements follow a "top down" evaluation schedule that looks at enhanced sampling, technology evaluation, toxics use reduction and pollution prevention and raw material substitution evaluation.	Monitoring requirements established in permit (compliance schedule or specific conditions) and through ODEQ guidance	Compare Stormwater Benchmarks, NPDES or IU Permits	Exact capital would depend on the feasibility analysis			Engineering costs could be significant. Estimate $50-100k for municipal and industrial permittees	Fits nicely with planned comprehensive SB 737 work and step-wise implementation of the 17.5 g/day standard and application of the RPA, both of which have not been fully implemented by ODEQ and the regulated community	Could potentially avoid political and legal quagmires of multiple new impairments, listings and fish advisories	Would specifically be designed to provide for technical feasibility	Could potentially help avoid significant legal costs for all parties		Has meaningful progress that has a medium level of cost
De Minimis	**General Approach:** Establish pollutant-specific PQL, MDL or ML (or alternative) as a *de minimis* values for each of the HH WQ Criteria COC's.	Regulatory Narrative Approach	HH WQ Criteria below feasible quantitation or removal by FCR increase	Point Sources and POTWs	Discuss	Oregon does not regulate below QL, except for dioxin TMDL	Yes, PQLs are established and become basis of permit limit	ODEQ include in WQ standards narrative	Monitoring established in permits	NPDES, Stormwater and IU permits				Capital and O&M likely required for some to achieve de minimis levels	Solves some practical and technology gap problems	Meaningful, practical tool for all parties involved	High, requires monitoring	May currently be used by default, without specific narrative	High	High
Bifurcated criteria	**General Approach:** Using WQ toxics prioritization based on fish consumer studies, establish a two-part WQ Criteria. Focus available resources on the highest priority pollutants that drive human health concerns, avoiding one-size-fits-all unintended consequences	Regulatory	Revise WQ criteria for top priority list toxics (examples: pesticides, methyl mercury and PCBs)	Point sources and POTWs	TBD	No	No	3 parties establish two-tiered priorities consistent with other regulatory programs including SB 737 and state and regional toxics reduction priorities and timelines	Monitoring established in permits	NPDES, Stormwater and IU permits	TBD	TBD		Capital and O&M likely required for some to meet WQ standards	Focuses municipal, industrial and public resources on problem COC's	Equivalent toxicity reduction results achieved at more technically and economically feasible levels. Dovetails with SB 737, LCREP and other state and region-wide toxics reduction priorites.	More feasible than an across-the-board WQ Criteria revision	ODEQ develop rationale and narrative for rulemaking	May be more saleable to public	Medium

Pathways to Compliance
DRAFT

16-Jun-08

Regulatory Approach	Compliance Approach	Regulatory Tools 1st Permit Cycle	Regulatory Tools 2nd Permit Cycle
Water Quality Standard	>Numeric Limit in Permit >Technology based (advanced)	Compliance Schedule Variance Pass through or intake credit	UAA? Variance Pass through / intake credit Offsets / trading
	>Numeric Limit in Permit >Toxics Reduction Programs plus Best Conventional Treatment	Compliance schedule Toxics Reduction Program implement monitor	If # met - continue with no compliance schedule If # not met: Variance, UAA? Pass through/intake credit Offsets/trading
	>WQ Benchmark in Permit >ToxicsReduction Programs plus Best Conventional Treatment	Analysis to determine sources & reduction methods Develop & Implement Toxics Reduction program Benchmarks would work like Phase I stormwater permits	Compliance schedule Variance Pass through / intake credit UAA? Offsets / trading

FIIAC Committee Presentation to Environmental Quality Commission 8/22/2008

Chair Blosser and Commissioners,

My name is Rich Garber, I am the corporate environmental manager for Boise Inc. It has been my pleasure to serve on the DEQ's Fiscal Impacts and Implementation Advisory Committee (FIIAC) these past 8 months as the representative for Associated Oregon Industries (AOI).

As the AOI representative on the FIIAC committee, I felt it was not only important to represent the interests of small business and industrial point source dischargers and NPDES wastewater permit holders in the discussion regarding impacts of an increased fish consumption rate; but to also bring my NPDES permitting experience and knowledge to the committee as someone who has worked for nearly 20 years applying for, negotiating, reviewing, and implementing the many requirements of NPDES permits at industrial facilities. Based on my experiences and knowledge of the NPDES permit process, I would like to offer a few brief comments and concerns regarding an increase in Oregon's fish consumption rate and the related impacts.

1. Under Oregon's existing rules (and EPA and DEQ's implementation and interpretation of them) most, if not all, of the flexible implementation options that the FIIAC and DEQ have discussed are not currently in use in Oregon. The one option that has been used by ODEQ in the past (compliance schedules) is currently under litigation with EPA.
2. The Clean Water Act, as a strict liability statute, places the burden of compliance on the NPDES permit holder. Companies that hold NPDES permits need to be legally certain that they meet the terms of their permits in order to conduct their business and make investments in their facilities. Permit holders want to comply with their permit limits 100% of the time! Where regulatory and legal uncertainty exists it will be disruptive to Oregon's businesses.
3. Traditional end-of-pipe compliance and controls would be extremely costly (multiple billions) for Oregon's small businesses, industry and municipalities, if required to meet the revised fish consumption rate and accompanying changes in water quality criteria. Currently, these end-of-pipe controls are unproven for large wastewater treatment systems, and would require many years of research and study specific to each facility with its unique wastewater characteristics. Even if these controls could be afforded, technical feasibility is unknown.
4. An increase in the fish consumption rate and accompanying reductions in the state's water quality criteria must be **practically implementable** for Oregon's industry, municipalities, small businesses, and the DEQ. Implementation rules must pass EPA scrutiny, and (ultimately) that of the public and legal community.
5. Without first having the necessary NPDES implementation tools (examples discussed: pass through credits, de minimis, technical or economic feasibility off-ramps, etc.) available for use in Oregon statutes, approval of an increased fish consumption rate and accompanying revisions to water quality criteria would place Oregon's municipal, industrial and small business permit holders on precarious legal footing with regard to their NPDES permits. This type of regulatory and legal uncertainty would not be good for Oregon's business climate, and could result in a great deal of litigation costs for all involved, rather than a reduction in toxics in fish and improved tribal and consumer health.

These concerns are raised in the spirit of good faith and cooperation with this commission and the DEQ, and with the shared interest in working toward efficient, practical and legally valid solutions for implementation of any revision to the fish consumption rate. Thank you for allowing me to present this to you today, and for your time and consideration of these comments.

Item O Handout

Rich Garber

HDR Report to the NWPPA: *"Increasing the Fish Consumption Rate: Report of Fiscal Impact to Select Northwest Pulp & Paper Mills"*

HDR Engineering, Inc.
412 E. Parkcenter Blvd., Suite 100
Boise, ID 83706

EXECUTIVE SUMMARY

The Oregon Department of Environmental Quality (ODEQ), United States Environmental Protection Agency (EPA) and Confederated Tribes of the Umatilla Indian Reservation (CTUIR) are planning to make human health water quality criteria (HHWQC) more stringent. This change is due to indications by CTUIR that some of its members consume fish at a greater fish consumption rate (FCR) than the FCR that HHWQC are currently based on. If the FCR used for establishing HHWQC is increased, HHWQC will correspondingly become more stringent.

The initiative to determine the need and justification for the more stringent WQC is referred to as the Oregon Fish and Shellfish Consumption Rate Project and was started by ODEQ, EPA and CTUIR. As part of the project, the ODEQ commissioned Science Applications International Corporation (SAIC) to prepare a report evaluating necessary actions and costs to meet more stringent WQC. SAIC completed this report in January 2008 and it is named *Cost of Compliance with Water Quality Criteria for Toxic Pollutants for Oregon Waters*. It is the opinion of several point source dischargers that the SAIC report did not fully capture costs associated with achieving statewide compliance with revised HHWQC and the costs presented were significantly underestimated. In addition, the report did not sufficiently address the ability of currently available technology to meet the new HHWQC particularly when the HHWQC is below analytical method detection limits.

The purpose of this study and report is to verify the HHWQC that must be met, determine if proposed technologies will meet the limits, and develop an opinion of probable cost for implementing and operating these technologies. Since several of the proposed technologies have not been tested or advanced beyond bench-scale testing, there is much uncertainty in the full-scale applicability of some of the technologies. Therefore, bench testing, pilot-plant testing and/or full-scale demonstrations would be needed to verify with greater accuracy the actual achievable effluent quality for these technologies.

This report develops an opinion of fiscal impacts to the Oregon pulp and paper industry due to more stringent HHWQC from increased FCR. The following report methodology was used to determine these impacts:

1. Collection and review of treated wastewater effluent data from four different pulp and paper mills.
2. Determination of current HHWQC and potentially more stringent HHWQC due to increased FCR; these criteria were then compared with mill final effluent data.

3. A list of candidate treatment technologies was developed for removing these constituents by reviewing studies pertinent to the Fish Consumption Project. Additional literature was reviewed as well to determine other potential treatment technologies.
4. Treatment technologies were screened for reliability and feasibility in meeting applicable HHWQC.
5. Capital and operational cost opinions were developed for the screened treatment alternatives.

Four representative mills were evaluated for this report and are summarized below. :

Mill A – Bleached Kraft Process
Mill B – Unbleached Kraft Process
Mill C – Thermomechanical Pulping/Deink Process
Mill D – Bleached Kraft Process

Data from the four mills was compiled, averaged and compared to HHWQC at increased FCRs. HHWQC at increased FCRs were calculated with the aid of a computer model spreadsheet developed by the ODEQ. The spreadsheet utilizes epidemiological data including reference doses, bioconcentration factors, carcinogen slope factors and other parameters to determine WQC for a given FCR, water intake and body weight.

The model was run at three different FCRs including 17.5 g/day, 63.2 g/day, 113 g/day and 175 g/day. Current WQC is based on a FCR of 17.5 g/day. Changes to WQC by ODEQ could be based on a FCR as high as 175 g/day. The spreadsheet model shows that current mill effluent quality may exceed some of the HHWQC at the elevated FCRs.

It is critical noting that the lowest method detection limit (MDL) for all EPA-approved analytical methods is greater than the new HHWQC for some constituents. While this report identifies potential technologies for removing these constituents, it is impossible to know for certain whether technologies actually can or cannot meet HHWQC since there is no way to accurately measure at such low concentrations at this time. Despite the inability to measure accurately to the HHWQC, it is expected that point source dischargers would still need to plan to meet HHWQC since more sensitive analytical methods could become available. Furthermore, regulating authorities would expect point source dischargers to meet WQC whether or not analytical methods could accurately detect below the WQC.

HHWQC limits at increased FCRs are extremely stringent compared to other environmental standards. HHWQC at increased FCRs should be scrutinized to compare the value of improving water quality with to the actual protection to human health. For example, revised HHWQC at increased FCRs are multiple orders of magnitude more protective than national drinking water standards. Another comparison of note is background water quality. A review of current water quality shows that many of the revised HHWQC may already be exceeded in Oregon surface waters. Therefore, the

opportunity for applying pass-through credits to point source dischargers should be considered where background constituent levels are high.

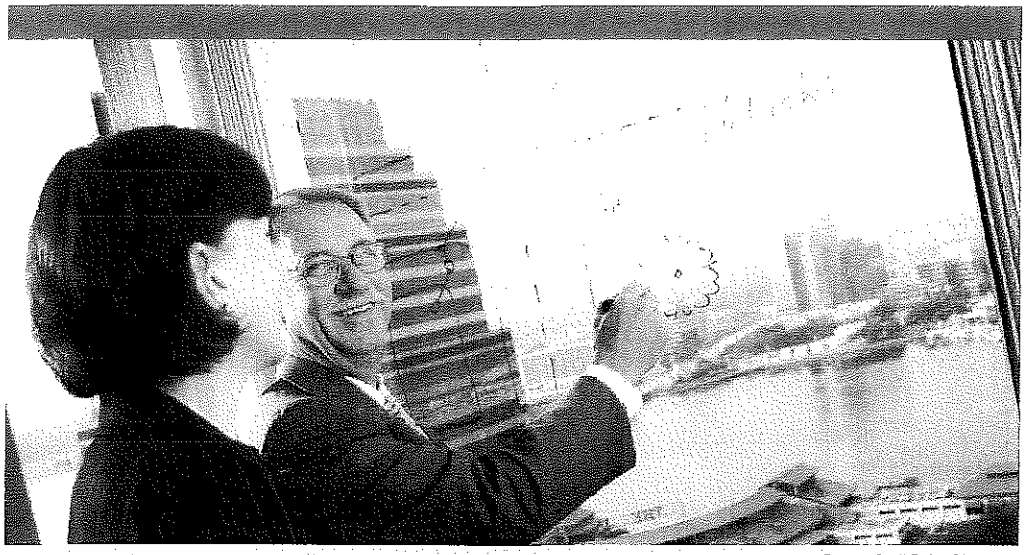
A literature review of treatment technologies was completed to determine which, if any, technologies can reliably meet the revised HHWQC at higher FCRs. The literature review showed that most published results for constituent removal are related to higher untreated constituent concentrations and technologies for achieving less stringent effluent criteria. These less stringent effluent criteria (including drinking water standards) are orders of magnitude greater than HHWQC for this study. As a result, little research has been conducted investigating constituent removal technologies to extremely low levels. Therefore, published literature does not support or deny that more stringent HHWQC can be met using currently available technologies. Technologies suggested for meeting low level constituents (mostly for metals) included iron coprecipitation, granular activated carbon, ion exchange, nanofiltration and reverse osmosis. Further evaluation of the technologies showed that iron coprecipitation, nanofiltration and reverse osmosis would have the best possibility of meeting HHWQC at increased FCRs and were then evaluated for cost.

Capital and O&M cost opinions for the four mills were evaluated for the three candidate technologies. The costs are summarized below.

Summary of Capital, O&M and Annualized Costs

		Mill A	Mill B	Mill C	Mill D
Capital Costs	Iron Coprecipitation	$31,000,000	$25,000,000	$19,000,000	$34,000,000
	Nanofiltration	$91,000,000	$67,000,000	$41,000,000	$101,000,000
	Reverse Osmosis	$107,000,000	$79,000,000	$48,000,000	$119,000,000
Annual O&M Cost	Iron Coprecipitation	$28,000,000	$20,000,000	$11,000,000	$31,000,000
	Nanofiltration	$9,500,000	$6,700,000	$3,900,000	$10,500,000
	Reverse Osmosis	$10,500,000	$7,400,000	$4,300,000	$11,700,000
Annualized Costs (10 yrs, 7%)	Iron Coprecipitation	$32,000,000	$24,000,000	$14,000,000	$36,000,000
	Nanofiltration	$22,000,000	$16,000,000	$10,000,000	$25,000,000
	Reverse Osmosis	$26,000,000	$19,000,000	$11,000,000	$29,000,000

Cost provided above represent only four of the eight large mills located in Oregon. The cost related to simply installing technology to meet revised HHWQC at increased FCRs is significant and would cost the Oregon pulp and paper industry in excess of $500 million. In addition, annual costs to operate these technologies would cost Oregon pulp and paper mills in the range of $30 to $90 million annually. While costs are significant, there is no certainty at this time that revised HHWQC could be met using existing technology. Steps forward should first ensure that technologies are available for meeting more stringent HHWQC before significant capital expenditures are made.



Source: Scott Dobry Pictures

Business Indicators

- Ranked No. 19 among *Engineering News-Record*'s 2007 "Top 500 Design Firms"
- Projects in all 50 states and in 60 countries
- More than 90 years of client service

HDR is an architectural, engineering, planning and consulting firm that excels at helping clients manage complex projects and make sound decisions.

As an integrated firm, HDR provides a total spectrum of services for our clients. Our staff of professionals represents hundreds of disciplines and partner on blended teams nationwide to provide solutions beyond the scope of traditional A/E/C firms.

HDR's operating philosophy is to be an expertise-driven national firm that delivers tailored solutions through a strong local presence. HDR's ability to draw upon companywide resources and expertise is a great strength in meeting and exceeding your expectations.

History and Size

- Founded in 1917
- More than 7,500 employee-owners
- More than 165 locations worldwide
- Full-service, multidisciplinary staff

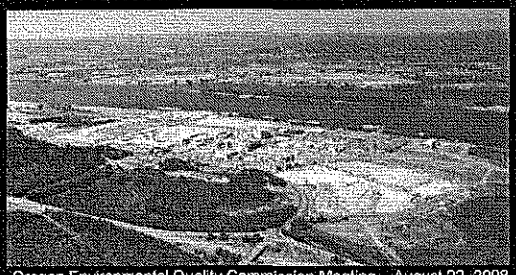
Service Areas

HDR provides solutions that help clients manage complex projects in the following areas:

- Civic
- Community Planning & Urban Design
- Construction Services
- Design-Build
- Economics & Finance
- Environmental
- Healthcare
- Interior Design
- Management & Planning Services
- Power & Energy
- Program Management
- Project Development
- Science & Technology
- Security
- Sustainable Design
- Transportation
- Water/Wastewater

Item 0 Handout
Rich Garber

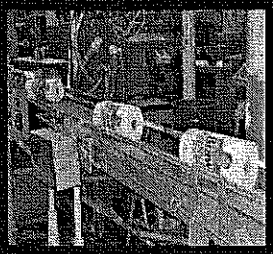
Cost of Compliance for Revised Toxics Water Standards



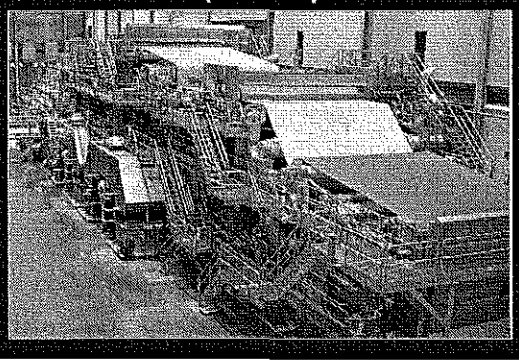
Oregon Environmental Quality Commission Meeting – August 22, 2008
(Also presented at June 27, 2008 Oregon DEQ Public Workshop)
Northwest Pulp and Paper Association

NWPPA Presentation

1. Who is NWPPA?
2. Report Background
3. Treatment Costs
4. Spokane TMDL Case Study
5. Risk Reduction in Fish
6. NWPPA Concerns



The NW Pulp & Paper Assn.?



Why NWPPA's Cost Study?

- NWPPA participates in public processes affecting our operations
- NWPPA members have previous experience with toxics water quality issues
- Pulp mill effluent has characteristics that make it challenging to treat (high organic matter from trees)
- Ability of treatment technologies to meet stringent water quality criteria not fully addressed by original SAIC report
- SAIC report did not adequately evaluate costs to meet new water quality criteria

Water Criteria Translate into Water Permit Limits

- More stringent water quality criteria = reduced NPDES discharge limits in the current Oregon water permitting environment
- Compliance with permit limits 99.9% of the time is our goal
- No proven treatment to meet the human health water quality standard criteria under discussion.
- Costs will be prohibitive for available treatment technologies. Annualized costs may approach the actual value of the mills.

NWPPA Concerns--SAIC Study

- NWPPA disputes the SAIC assumptions:
  - No technology requirements for non-measurable constituents
  - If no proven end-of-pipe technologies, dischargers will be eligible for variances
  - Cost estimates based on 10 year time frame
- NWPPA believes under current regulatory scenarios, more stringent standards will drive:
  - Numeric limits in permits
  - Expensive treatment technology
  - Huge legal risks for permit holders in an uncertain regulatory scenario - no ability to plan or expand
  - Competition issues with our global competitors

NWPPA Study Assumptions

- OR DEQ spreadsheet used to calculate human health water quality criteria at elevated fish consumption rates - range of 63 - 389 g/day
- *Study assumes technologies must meet new effluent limits -- even if new limits below detection limits*
- Literature Review showed little evidence that ultra-low effluent limits are achievable with current technology
- 17.5 g/day was considered the baseline; however, most point sources do not have permits incorporating the current criteria

NWPPA Report Methodology

- Human health water quality criteria calculation
- Literature review of treatment technology
- Treatment technology review and screening
- Cost Development

NWPPA Treatment Options Studied

- Iron Coprecipitation
- Granular Activated Carbon
- Ion Exchange
- Nanofiltration
- Reverse Osmosis
- Each option has advantages and disadvantages.

Iron Coprecipitation

Advantage	Disadvantage
1. Low capital cost	1. High chemical costs
2. Conventional technology	2. Large quantity of total dissolved solids added to effluent
	3. High operating & maintenance costs

Granular Activated Carbon

Advantage	Disadvantage
1. Moderate costs	1. Adds arsenic to effluent
	2. Adsorbs organics
	3. Filter blinding, making pretreatment necessary
	4. Not commonly used for metal removal

Ion Exchange

Advantage	Disadvantage
1. Moderate costs	1. Difficult to remove multiple constituents
2. Appears effective at removing individual metals	2. Non-regenerable resin
	3. High disposal costs
	4. Resin fouling/blinding, pretreatment necessary

Nanofiltration

Advantage	Disadvantage
1. Moderate cost	1. Filter blinding, pretreatment necessary
2. Appears effective at removing metals	2. High capital costs - -significant quantity of concentrate to treat and/or dispose

Reverse Osmosis

Advantage	Disadvantage
1. Most advanced method of treatment	1. Significantly high capital cost
2. Effectively removes all dissolved constituents	2. Significant quantity of concentrate to treat/dispose
	3. Nonselective, removal all dissolved ions
	4. Pretreatment required
	5. High operating and energy costs

Summary of Capital Costs: One Mid-sized OR Mill

	Capital Costs
Iron Coprecipitation	$ 25 Million
Nanofiltration	$ 67 Million
Reverse Osmosis	$ 79 Million

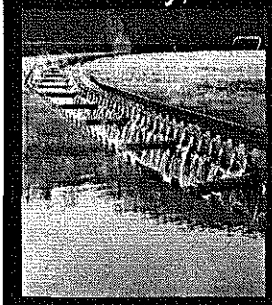
Summary of O&M Costs: One Mid-Sized OR Mill

	Annual Operating & Maintenance Costs
Iron Coprecipitation	$ 20 Million
Nanofiltration	$ 6.7 Million
Reverse Osmosis	$ 7.4 Million

Summary of Annualized Costs: One Mid-sized OR Mill

	Annualized Costs (10 years at 7%)
Iron Coprecipitation	$ 24 Million
Nanofiltration	$ 16 Million
Reverse Osmosis	$ 19 Million

P&P Compliance Issues: Reality, Pilots and Lawsuits



- These types of treatments are meant for small highly concentrated waste streams not typically used in our industry
- Additional costs are in engineering design, pilot testing, agency permitting, modeling and start up
- Uncertain whether technology can deliver compliance 99.9% of the time (compliance issues)

Spokane TMDL Case Study Reality of NW Permit Scenario

- Washington's Spokane River Phosphorus TMDL is under development
- Numeric limits in permits are below technology's ability to treat wastewater.
- EPA required numeric permit limits for point sources.
- NWPPA concern remains agency ability to employ available implementation measures.
- Ecology will allow offsets for non-bioavailable phosphorus.

What About Reducing Risks from Eating Fish?

- NWPPA believes that if human health is the concern -- the solution should target and reduce chemicals that pose a human health risk via fish consumption
- We suggest that risk from salmon is not being driven by current NPDES discharges from point sources, but rather constituents of concern are:
  - Naturally occurring earth metals
  - Banned organics substances like PCBs
  - Banned pesticide

Constituents of Concern

- Surveys
  - NWPPA Survey of Dioxin in Fish Tissue (1991)
  - Bi-State (1995)
  - EPA CR Basin Fish Contaminant Survey (1996-8)
  - Willamette River Surveys and Portland Harbor
- Virtually identical outcomes

  "Most frequently detected chemicals in fish tissue were 14 metals, DDT and its structural analogs (DDD, DDE), chlordane and related compounds (cis-chlordane, trans-chlordane, cis-nonachlor, trans-nonachlors, and oxychlordane), PCBs (arochlors and dioxin-like PCBs) and dioxins and furans" EPA (1996-8) EPA 910-12-02-006 (p. E-3)

Details on Specific Risk Drivers

- Mercury
  - Atmospheric deposition of mercury is an important controlling factor in fish tissue mercury in the west. *Rationale: fish tissue mercury occurs in a narrow range but geologic sources occur in a an order of magnitude of 2-3 times.*
  - Atmospheric modeling has shown Asian long-range transport. *EPA/OSU Environmental Science and Technology, Vol. 41, No 1 (2007)*
  - Willamette TMDL work shows point sources to be *de minimus*

Details on Specific Risk Drivers

- Arsenic
  - Known carcinogen, but toxicity is in question. Majority found in fish tissue is organic arsenic which is thought to be less toxic than inorganic.
  - Portland Harbor work includes reference site data which could be useful in determining background levels, which are thought to be relatively high
  - Bi-State work found <1% loading to Lower Columbia River is from point sources and both arsenic and mercury are highly associated with sediment loads. *Draft Identification of Sources of Pollutants to LCR Basin (1996)*

Alternative Approaches

NWPPA does not support an order of magnitude or greater increase in the current 17.5 g/day-based criteria; rather we support exploring effective alternatives that will also mitigate prohibitive treatment/regulatory and legal costs:

1. Only raising fish consumption factor for chemicals driving risk in fish tissue
2. Allowing phased implementation so that first round of NPDES permits would use standards as benchmarks for compliance purposes
3. Use of narrative standards and *de minimus* provisions
4. *Pass-through credits for naturally occurring compounds*

NWPPA Ongoing Concerns

- 60% of proposed standards at 175 g/day are below scientific measurement limits (Source: DEQ 2008)
- Proposed standards exceed capability of commonly used treatment technology
- Prohibitive end-of-pipe treatment costs
- Negative economic effects on Oregon's economy
- Whether implementation of revised WQS criteria in revised NPDES permits will produce a meaningful reduction of risk associated with fish consumption
- Fair implementation across business sectors
- Reliable and sustainable compliance using advanced treatment technology uncertain and extremely costly

Wrap Up and Questions

Thank you!

Contact:
Northwest Pulp and Paper Association
1300 114th Ave. SE, Suite 200
Bellevue, WA 98004
P: 425-455-1323

Oregon Environmental Quality Commission

Fish Consumption Standards
Oregon Association of Clean Water Agencies
22 August 08

Chair Blosser and Members of the Commission:

I am Charlie Logue, a Board member of the Oregon Association of Clean Water Agencies (ACWA). ACWA is a private not-for-profit organization of Oregon wastewater treatment and stormwater management utilities, along with associated professionals. Our 118 statewide members are focused on protecting and enhancing Oregon's water quality.

ACWA has been involved in the issues surrounding fish consumption rates for many years, and we appreciate our continuing discussions with you.

As ACWA members including myself and Peter Ruffier have shared with the EQC in our presentations before the Commission on this issue over time, ACWA has long advocated that an increase in the Oregon fish consumption rate should focus on true toxic reduction to reduce human health risk to Tribal members and all Oregon fish consumers.

We have had many discussions with Tribal governments, DEQ and EPA staff, and others regarding the implementation of an increased fish consumption rate, and look forward to continuing to contribute to a rule package for EQC adoption. We are committed to an increased fish consumption rate and resulting revised a water quality standard that is implementable by Oregon communities. Items such as water quality trading, effective use of pollution prevention programs, provisions for metals in drinking water intake water, and other ideas are all excellent concepts to evaluate in crafting a fish consumption rate that is implementable.

It is important for the Commission to recognize that at the fish consumption rate being contemplated (175 grams per day), some water quality standards will be set below detection levels. The proposed rules incorporating an increased fish consumption rate must be adequately detailed to provide the Department, Tribal governments, permit holders, and the public, clear information about how complex technical permitting issues will be handled.

We would advocate the EQC provide additional direction to DEQ on two important additional elements to be incorporated in the fish consumption rate rule making process.

One, coordinate the fish consumption rate rule making efforts and the SB 737 requirements to prioritize and reduce Persistent Bioaccumulative Toxics for Oregon.

Secondly, the Commission should be using the energy and attention of this process to focus on true toxics reduction. A comprehensive integrated toxic reduction strategy that focuses the current environmental authorities on reducing the toxics of greatest risk for fish consumers should accompany the increased fish consumption rule adoption. We would be glad to share our specific ideas on toxic reduction programs at the appropriate time.

Thank you for your time, and I would be glad to answer any questions.

Item O Handout

CONFEDERATED TRIBES OF
COOS, LOWER UMPQUA AND SIUSLAW INDIANS
TRIBAL GOVERNMENT OFFICES
1245 Fulton Ave. • Coos Bay, OR 97420 • (541) 888-9577 • 1-888-280-0726
General Office Fax: (541) 888-2853 • Administration Fax: (541) 888-0302

RESOLUTION NO: 07-057
Date of Passage: May 20, 2007
Subject (title): Support for an Increase in Oregon's Fish Consumption Rate

WHEREAS: This Council is the Governing Body of the Confederated Tribes of Coos, Lower Umpqua and Siuslaw Indians and is authorized to act on behalf of said Tribes;

WHEREAS: Native fish and shellfish are culturally significant to the Tribes;

WHEREAS: The Tribes have a relatively higher fish and shellfish consumption rate than Oregon's general population;

WHEREAS: Oregon's current fish consumption rate of 17.5 grams/day, which is about eight ounce meals per month, does not accurately represent tribal member fish and shellfish consumption rates.

NOW THEREFORE BE IT RESOLVED, that the Tribes support an increase in Oregon's fish consumption rate.

CERTIFICATION: On May 20, 2007, this recommendation was approved at a Regular Tribal Council Meeting held this date, and the vote was:

7 FOR
0 AGAINST
0 ABSTAIN

Bob Garcia, Chair

Mark Ingersoll, Vice-Chair

CONFEDERATED TRIBES OF COOS,
LOWER UMPQUA & SIUSLAW INDIANS

Councilman

Item O Handout

The Confederated Tribes of the Grand Ronde Community of Oregon

Tribal Council
Phone (503) 879-2301
1-800 422-0232
Fax (503) 879-5964

9615 Grand Ronde Rd
Grand Ronde, OR 97347

Resolution No. **077-08**

WHEREAS, the Grand Ronde Tribal Council, pursuant to Article III, Section I of the Tribal Constitution approved November 30, 1984, by the Acting Deputy Assistant Secretary of the Interior, Indian Affairs, is empowered to exercise all legislative and executive authority not specifically vested in the General Council of the Confederated Tribes of the Grand Ronde Community of Oregon; and

WHEREAS, WHEREAS, the Tribal Council believes it is in the best interest of the Tribal membership to protect Tribal member health as well as Tribal cultural and natural resources within its Reservation, its ceded lands, and other lands of cultural interest; and

WHEREAS, Tribal member health and Tribal cultural and natural resources are affected by activities outside the Reservation; and

WHEREAS, there is toxic contamination in fish found in the Willamette and Columbia River basins, as well as in other water bodies within the Tribe's ceded lands and across Oregon; and

WHEREAS, Tribal members, like many Native Americans, consume fish at much higher rates than average Oregonians or average Americans and are therefore subject to higher levels of risk from toxic contamination in fish; and

WHEREAS, Tribal members are largely dependent upon the State of Oregon to protect their health from environmental toxins; and

WHEREAS, Oregon's 2004 revised fish consumption rate of two small meals of fish per month does not represent or protect Oregon's tribal members and should be abandoned; and

WHEREAS, the Confederated Tribes of the Umatilla Indian Reservation and the Confederated Tribes of the Warm Springs Reservation of Oregon have conducted full scientific fish consumption surveys, and the 99th percentile fish consumption rate for tribal members is 389 grams of fish per day, according to the surveys; and

WHEREAS, the Tribal Council believes fish consumption rates in fish consumption surveys by the Confederated Tribes of the Umatilla Indian Reservation and the Confederated Tribes of the Warm Springs Reservation of Oregon are adequate to represent the consumption patterns of the Tribal membership and an independent fish consumption survey of the Tribal members is not needed to increase Oregon's fish consumption rate; and

WHEREAS, the Tribal Council approved Resolution No. 058-07 in 2007 which (1) supported the Confederated Tribes of the Umatilla Indian Reservation's request that Oregon increase its fish consumption rate to protect all tribal members in Oregon, (2) supported Oregon's willingness to review and revise its fish consumption rate to protect tribal members and all other Oregonians with higher fish

consumption rates, (3) strongly encouraged Oregon to adopt a fish consumption rate that is consistent with the consumption rates in the Confederated Tribes of the Umatilla Indian Reservation and Confederated Tribes of the Warm Springs Reservation fish consumption surveys and that is consistent with EPA's guidance to use local data and with EPA's guidance for rates necessary to protect subsistence fish consumers, and (4) committed Tribal Council to participating and assisting Oregon to increase its fish consumption rate in 2007 and 2008 and directed staff to participate and provide regular briefings to the Tribal Council; and

WHEREAS, the Tribal Council believes that the 99th percentile fish consumption rate of 389 grams of fish per day from the fish consumption surveys of the Confederated Tribes of the Umatilla Indian Reservation and the Confederated Tribes of the Warm Springs Reservation of Oregon is a fish consumption rate that is adequate to help protect Tribal members from the health risks associated with eating contaminated fish from Oregon waters and to help protect fish populations and ecosystem health; and

WHEREAS, the Tribal Council believes that a fish consumption rate of at least 389 grams of fish per day is consistent with EPA's guidance to use local data and with EPA's guidance for rates necessary to protect subsistence fish consumers, as well as with Oregon's duty to protect tribal members and all Oregonians; and

WHEREAS, the Legislative Action Committee has recommended that the Tribal Council pass a Resolution: (1) supporting a fish consumption rate of at least 389 grams per day as being adequately protective of Tribal member health and the environment, for adoption by the state of Oregon for the purpose of setting water quality standards in Oregon and (2) strongly encouraging Oregon to adopt a fish consumption rate of no less than 389 grams per day for the purpose of setting water quality standards, so that Tribal member health and the environment may be adequately protected.

NOW THEREFORE BE IT RESOLVED, that the Tribal Council hereby supports a fish consumption rate of at least 389 grams per day as being adequately protective of Tribal member health and the environment, for adoption by the state of Oregon for the purpose of setting water quality standards in Oregon; and

BE IT FURTHER RESOLVED, that the Tribal Council strongly encourages Oregon to adopt a fish consumption rate of no less than 389 grams per day for the purpose of setting water quality standards, so that Tribal member health and the environment may be adequately protected.

CERTIFICATION: the Tribal Council of the Confederated Tribes of the Grand Ronde Community of Oregon adopted this resolution at a regularly scheduled meeting, with a quorum present as required by the Grand Ronde Constitution, held on **May 07, 2008,** by a vote of **5** yes, **0** no and **0** abstentions.

Cheryle A. Kennedy
Tribal Council Chairwoman

Steven L. Bobb, Sr.
Acting Tribal Council Secretary

Item O Handout

The Klamath Tribes
Tribal Council

August 19, 2008

Written statement to the EQC regarding the Oregon Fish and Shellfish Consumption Rate

Dear Chairman Blosser and Members of the Environmental Quality Commission:

Thank you for the opportunity to present the position of the Klamath Tribes on Oregon's Fish and Shellfish Consumption Rate. It is regrettable that scheduling conflicts, resulting from commitments during the Klamath Tribes Annual Restoration Celebration, prohibit attendance of a Klamath Tribal Council delegation at the meeting today. Because the Klamath Tribes are unable to attend this meeting to communicate our position on this very significant issue in person, we have asked Kathleen Feehan, Senior Policy Analyst, the Confederated Tribes of the Umatilla Indian Reservation, to present this written statement, letter, and Tribal Council Resolution in our behalf.

We, the people of the Klamath Tribes, the Klamath, Modoc, and Yahooskin Band of Snake Indians, commend the Confederated Tribes of the Umatilla Indian Reservation for their work and dedication to this effort to ensure protection of Native American's in our region from potential health risks associated with consuming fish and shellfish obtained from Oregon waters. We thank Kathleen for agreeing to present our position to you, and are honored that she has agreed to do so.

Respectfully,

Joseph Kirk, Chairman
The Klamath Tribes

501 Chiloquin Blvd. – P.O. Box 436 – Chiloquin, Oregon 97624
(541) 783-2219 – Fax (541) 783-3706

The Klamath Tribes

Tribal Council

August 19, 2008

Oregon Environment Quality Commission
Department of Environmental Quality
Water Quality Division
811 SW Sixth Avenue
Portland, OR 97204-1390

Re: Oregon Fish and Shellfish Consumption Rate

Dear Chairman Blosser and Members of the Environmental Quality Commission:

The Klamath Tribes hereby submit Klamath Tribal Council Resolution #2008-23, which states the Klamath Tribes' position on the Oregon Fish and Shellfish Consumption Rate. This resolution is presented for your consideration in adopting an increased fish and shellfish consumption rate for Oregon.

It is the position of the Klamath Tribes that Oregon's current fish consumption rate is woefully insufficient to ensure reasonable protection for Oregon's fish consumers from health risks that may be associated with consuming fish obtained from Oregon waters. It is imperative that Oregon adopt a rate sufficient to protect all Oregon's fish consumers. It is well documented that Native Americans of the Pacific Northwest, including the Klamath Tribes, are among those people groups who consume high quantities of fish obtained from the waters of Oregon. It is our position that Oregon's rate must be increased to ensure protection of the people of the Klamath Tribes. Therefore, the Klamath Tribes oppose adoption of any fish consumption rate less than 175 grams per day for Oregon. In addition, Pacific salmon must be included in the rate.

The Klamath Tribes greatly appreciate the commitment of the Environmental Quality Control Commission to protect the human health of Oregon's citizens. We thank you for the opportunity to provide input into the decision process, and ask for your full consideration of the Klamath Tribes' position to adopt an adequate rate.

Sincerely,

Joseph Kirk, Chairman
The Klamath Tribes

Enclosure: Klamath Tribal Council Resolution #2008-23

501 Chiloquin Blvd. – P.O. Box 436 – Chiloquin, Oregon 97624
(541) 783-2219 – Fax (541) 783-3706

The Klamath Tribes

Tribal Council

KLAMATH TRIBAL COUNCIL RESOLUTION #2008-23

KLAMATH TRIBAL COUNCIL RESOLUTION ADDRESSING OREGON'S FISH AND SHELLFISH CONSUMPTION RATE

WHEREAS, The Klamath and Modoc Tribes and the Yahooskin Band of Snake Indians signed the Treaty of 1864 establishing the Klamath Reservation; and

WHEREAS, The General Council of the Klamath membership is the governing body of the Tribes, by the authority of the Constitution of the Klamath Tribes (Article VI &VII, section IV E) as approved by the General Council and most recently amended on November 25, 2000; and

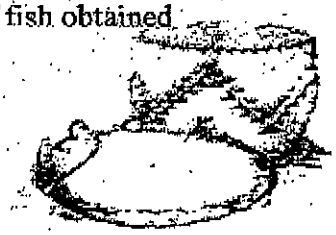
WHEREAS, The Klamath Indian Tribes Restoration Act of August 27, 1986 (P.L. 99-398) restored to federal recognition of the Sovereign Government of the Klamath Tribes; and

WHEREAS, The Klamath Tribes' Tribal Council is the elected governmental body of the Klamath Tribes and has been delegated the authority to direct the day-to-day business and governmental affairs of the Klamath Tribes under the general guidance of the General Council (Constitution, Article VII, section I; Tribal Council by-laws, Article I); and

WHEREAS, The Klamath Tribes maintain and exercise Treaty hunting, fishing, trapping, and gathering rights on lands and waters within the 1954 Klamath Reservation Boundary, located within the State Oregon; and

WHEREAS, The Klamath Tribes are dependent upon clean water, fish, game, and other natural resources for their subsistence, and which are critical to maintaining the cultural, traditional, and spiritual values and lifestyle of the Klamath Tribes; and

WHEREAS, Klamath tribal members regularly consume high quantities of fish obtained from the waters of Oregon; and



501 Chiloquin Blvd. – P.O. Box 436 – Chiloquin, Oregon 97624
(541) 783-2219 – Fax (541) 783-3706

WHEREAS, The State of Oregon possesses regulatory authority to manage water quality affecting Treaty resources of the Klamath Tribes; and

WHEREAS, Oregon's current 17.5 grams per day fish consumption rate is unquestionably inadequate, and does not ensure protection of Klamath tribal members from health risks associated with exposure to toxins that may be contained in fish obtained from Oregon waters;

THEREFORE BE IT RESOLVED, The Klamath Tribes support the conclusion of the Human Health Focus Group that Oregon's fish consumption rate should be based on fish consumers, not on calculations that include non-fish consumers; and

THEREFORE BE IT FURTHER RESOLVED, The Klamath Tribes support the position of the Human Health Focus Group, and the other Oregon tribes, that Pacific salmon should be included in Oregon's fish consumption rate; and

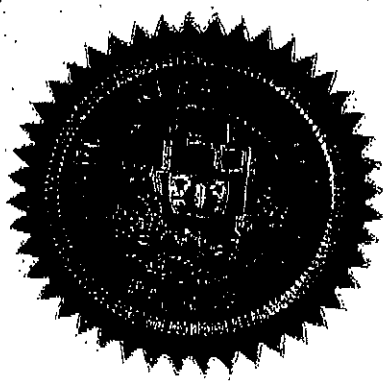
THEREFORE BE IT FINALLY RESOLVED, To ensure that the vast majority of Oregon's fish consumers, including Klamath tribal members and members from the other Oregon tribes, are provided reasonable protection from exposure to toxins that may be present in fish obtained from Oregon waters, the Klamath Tribes oppose adoption of any fish consumption rate less than 175 grams per day for Oregon.

CERTIFICATION

We, the undersigned, as Chairman and Secretary of the Klamath Tribes, do hereby certify that at a Regular Tribal Council meeting held on the 8th of MAY, 2008 where a quorum was present, the Tribal Council duly adopted this Resolution by a vote of 7 for, 0 opposed, and 1 abstaining.

By: Joe Kirk FOR
Joseph Kirk, Chairman
The Klamath Tribes

By: Torina Case
Torina Case, Secretary
The Klamath Tribes



Item O Handout

Resolution No. 2008 - 164

Date Approved: April 18, 2008

Subject: ODEQ Fish Consumption Rate

SILETZ TRIBAL COUNCIL

Resolution

WHEREAS, the Siletz Tribal Council is empowered to exercise the legislative and executive authority of the Confederated Tribes of Siletz Indians of Oregon pursuant to Article IV, Section 1 of the Siletz Constitution approved June 13, 1979, by the Acting Deputy Commissioner of Indian Affairs; and

WHEREAS, fish have long been a staple of Siletz Tribal members' diets in addition to being important culturally; and

WHEREAS, the Oregon Department of Environmental Quality (ODEQ) is currently in the process of examining the assumed fish consumption rate used in setting water quality standards for the State; and

WHEREAS, various studies have been conducted over the years to look at the fish consumption rates of U.S. citizens in general and Oregon citizens and tribal members who fish the Columbia River Basin in particular; now

THEREFORE BE IT RESOLVED, that the Siletz Tribal Council hereby chooses the fish consumption rate of the Environmental Protection Agency's national study of fish consumers (248 grams of fish per person per day) as the rate that it wishes ODEQ to adopt and that that rate should include all finfish and shellfish; and

BE IT FURTHER RESOLVED, that the Tribal Council hereby authorizes the Tribal Chairman, Vice-Chairman, and General Manager to sign any documents necessary to put forward the Siletz Tribe's position on this issue.

Confederated Tribes of Siletz Indians
By

Delores Pigsley, Tribal Council Chairman

CERTIFICATION

This Resolution was adopted at a Regular Tribal Council Meeting held on April 18, 2008, at which a quorum of the Tribal Council was present, and the Resolution was adopted by a vote of 7 FOR, 0 AGAINST, and 0 ABSTAINING, the Chairman or Vice Chairman being authorized to sign the Resolution.

By

Tina Retasket, Tribal Council Secretary

Confederated Tribes of Siletz Indians
P.O. Box 549 Siletz, Oregon 97380
(541) 444-2532 • 1-800-922-1399 • FAX: (541) 444-2307

April 8, 2008

Siletz Tribal Council Members,

I am writing you to request your consideration of the Fish Consumption Rate values that are currently being debated by Oregon DEQ, tribes and citizens of the State. This process has come to fruition in large part due to the efforts of the Umatilla Tribe's EPA funded staff and their concerns that came about as a result of the findings in an earlier Columbian River Intertribal Fish Commission study. To be brief, this earlier study found that tribal members who fish along the Columbia River system consume salmon and other fishes at a rate of up to 389 grams per day. The current State standard is 17 grams per day. These two numbers equate to 15 and 2 meals per month, respectively. Based on this discrepancy the Umatilla Tribe and the State of Oregon began a process of debating a need for new standards.

Toxics Background

From several other federal agency studies we know two things. One is that young fish are picking up numerous toxins when they swim out the lower Willamette and Lower Columbia rivers. We know that these same salmon continue to pick up toxins while at sea. We know that toxins move upward through the food chain - bacteria and plankton pick up the chemicals, shrimp eat the plankton and bacteria, bait fish eat the shrimp and salmon eat the bait fish. We also know from our work in areas like Portland Harbor that our factories, cities and farms are polluting our rivers and oceans and that the ocean does not pollute itself. We also know that the Columbia River plume is a location where great numbers of bait fish live and grow and that great numbers of salmon utilize this area to fatten up prior to their upstream spawning migrations.

Focus of Current Debate

Oregon DEQ is struggling with two main issues in this process. The first is whether to include salmon in the overall fish consumption rating because they quote "gather a significant portion of their toxics while at sea" and DEQ is only about regulating water quality in fresh waters of the State. The second is what consumer "population" to protect. I believe they have been considering the tribal population as "unique" or different from the rest of the population and in doing so have struggled with the idea of "affording" better protection to that population and what consequences might be incurred in offering that better protection.

As part of this process, the Oregon DEQ formed two committees to review the best available science. The first was made up of human health experts - PhDs from around the area. The second is made of up economists and muncipal folks. The first group has finalized their review with recommendations. The second is just getting started on their review. Regarding the Human Health committee's review, their recommendations were as follows: 1) DEQ should consider ONLY those people of the State that consume fish on a regular basis as that is the population you want to protect when setting regulations of this nature; 2) DEQ needs to include all finfish and shellfish regardless of whether they spend some time in the ocean; and 3) DEQ should use a percentile selection of 90% or higher. This last number refers to that portion of your fish eating population for which you reduce the risk of cancer, etc. For example if you have 2,665,700 folks living in Oregon and you want to reduce the risk for 90% of them you choose a 90th percentile value from your grams per day of fish eaten. That equates to 2,399,130 Oregonians. You in turn don't reduce the risk for the other 10% which is 266,570 Oregonians.

Opinions Regarding Debate

The following are my opinions based on discussions with industry folks, environmental lawyers, and tribal staff. Those folks lobbying against these "potentially" greater restrictions, which would protect more of the population, appear to be the pulp and paper industry and the municipalities up and down the Willamette. The pulp and paper industry appears to be afraid regulators will find new and high levels of heavy metals in their pipes. I am told various heavy metals are formed during the various chemical processes used in making paper. I am no expert on this topic. The municipalities are concerned that they can not deal with stricter regulation in large part because the scientific community in general has shown in the past ten years that we as citizens of the State "flush" all sorts of chemicals down our drains and we force the municipalities to clean those up with limited resources. The municipalities appear to be all for cleaning up the waters they are simply concerned with paying the economic and political price themselves. So with all this discussion comes talk of unaffordable price tags for reduced risk to citizens of the State.

What should essentially happen when this is all said and done is that if a higher standard (the amount of fish one can eat and have a reduced risk of cancer) goes in place then there becomes a "potential" to regulate "direct" source pollution (factory spill pipes) more seriously. That is to say as factories with spill pipes that flow into the Willamette relicense their facilities they might have to meet more stringent values for things like mercury, lead, arsenic, and PCBs. This would also be true of the municipal waste water treatment plants up and down our rivers and bays.

Consequences As I Understand Them

When considering manufacturing plants like the pulp and paper industry there always seems to be an argument of affordability. The only cost examples one might find are where lawsuits have resulted in changes and those changes had certain recorded costs

associated with them. The environmental attorney I spoke with told me their group has offered to drop a recent lawsuit against Georgia Pacific, for not cleaning up their arsenic outfall, if the company can show the cost will exceed at least 2% of their annual gross product. I can't speak to the accuracy of this statement but this seems like a survivable number and one that would likely offer a large sum of money to direct toward improved cleaning of toxics.

When considering the municipalities it is my belief that they simply don't want to deal with the political fallout of increased regulation. The pollution they receive comes from "non-point" sources or households and farms. To reduce that form of pollution we as citizens of the State need to stop using or dumping certain products. Fire retardants are a prime example. They are everywhere nowdays and they have deleterious effects on our babies and fish and other animals. One solution would be to not sell products containing fire retardants within our state boundaries. This of course would require legislative action. Without forcing regulation which in turn forces consequences we will never be able to change our current pollution patterns.

Lastly, an increase in regulation of toxics that are coming through our waste water treatment plants as well as from our "legacy bank account" of river sediments, would force the agencies to deal with clean up of existing toxics more quickly.

Rationale For Recommendations to Council

EPA completed a 20,000 person survey of fish consumption on a national scale. The results from this study suggested that when examining the consumer only population, on a national scale, including anadromous fish, that the 90th percentile was equal to 248 grams per day. What this means is that using this large database the EPA concluded that when you look at people who eat fish with some assumed regularity, that to protect up to 90% of those people, you need to use a consumption rate of at least 248 grams per day. It seems quite revealing to see that a national study shows these kinds of numbers without any consideration for race or culture. This supports the idea that Oregon DEQ should not assume that using numbers such as those provided by the scientifically sound Columbia River Tribal Fish Commission study is a representation of biasing the regulation toward Indian Country. That is to say, based on the national EPA study and the CRITFC study, Indian Country data and non-Indian Country data are very similar (Table 1).

Table 1. Fish consumption rates for two published studies cited in this letter.

Study	Grams per Day by Percent of Population With Reduced Risk			
	Median (50th)	**75th**	**90th**	**99th**
CRITFC looking at all tribal members	40	60	113	389
EPA National looking at fish consumers only	99	NA	248	519

This supports the argument that as tribal people first and Oregonians second we need to protect all fish consumers and that using both the national and regional studies suggest our rates should be somewhere significantly greater than 100 grams per day. My personal recommendation is 248 grams per day. When considering the Siletz tribal population of approximately 4000 members and the EPA study which found 28% of its sample folks consumed fish, one can complete the following calculation:

4000 members x 28% = 1120 members that are likely to be fish consumers. If you apply a 90th percentile to those folks you then find that you are reducing the risk of cancer for 1008 members and not reducing the risk for 112. For this small Siletz population 112 people seems plenty risky in itself but it's a more politically acceptable number than say the 99th percentile. Applying this same calculation to the general population of Oregon results in more than 74,000 people without reduced risk of cancer.

When considering the economic costs to manufacturers, farmers, cities, home owners, etc., I would suggest the following. We keep in mind how many people in our state spend money to catch a fish out of the river or sea, to eat fish at a restaurant or to simply spend their tourism dollars in areas associated with the existence of a healthy river or bay. If we keep polluting our fish our state will eventually be viewed as polluted and less attractive. You all know what that means in dollars. I believe these considerations in the long run out weigh those of factories and cities. I also believe we can stop polluting and make money if we chose to. I would encourage you to suggest economic considerations you are familiar with if you chose to write the Oregon DEQ a letter regarding this matter.

Recommendations

- Send DEQ a resolution covering this matter
- Focus on protecting those citizens that eat fish
- Focus on the 90th percentile or higher
- Use the EPA published study number of 248 grams per day
- Let DEQ know the economic importance of clean waters and clean fish

Sincerely,

Stan van de Wetering
Aquatic Projects Leader

Item 0 Handout

THE CONFEDERATED TRIBES OF THE WARM SPRINGS RESERVATION OF OREGON

NATURAL RESOURCES DEPARTMENTS
P.0. Box C, Warm Springs, Oregon 97761
Phone (541) 553-2001 — Fax (541) 553-1994

M E M O R A N D U M

TO: EQC

FROM: Roy Spino, Chairman Water Control Board, CTWS

DATE: August 22, 2008

SUBJECT: New Fish Consumption Rate for the State of Oregon

The Water Control Board and Tribal Environmental Office (TEO) spent a significant amount of time in 2005 and 2006 reviewing Ordinance 80, Tribal Water Quality Standards, Beneficial Uses, and Treatment Criteria as required by the Clean Water Act.

The major area of concern was the fish consumption rate used to calculate human health standards in regards to toxics. Several meetings involving EPA, the Water Control Board, and the TEO were held to better understand the topic. At the time, CTWS' fish consumption rate was 17.5 g/day. Local data suggested that this rate was considerably lower than actual fish consumption. EPA suggested the tribe use local data, if available, to develop its fish consumption rate. The Water Control Board decided to use CRITFC's 1994 Technical Report titled "A fish consumption survey of the Umatilla, Nez Perce, Yakama, and Warm Springs Tribes of the Columbia River Basin". Table 7 of this report listed several fish consumption rates and their level of protection. The Water Control Board's main concern was protecting the youth. Thus, the 170 g/day rate was used. This rate is protective of 95% of the adult population and 99+% of youth. Resolution 10,610, supporting the recommended fish consumption rate was presented to Tribal Council on March 21, 2006 and approved.

Currently the State of Oregon is reviewing their fish consumption rate. They have held a series of workshops over the last few years. The chairman of the Water Control Board and staff from the TEO has attended several of these workshops to support our newly adopted fish consumption rate. We, the Confederated Tribes of Warm Springs, support the State of Oregon in adopting a fish consumption rate of 175 g/day.

Roy Spino, Chairman Water Control Board, CTWS

THE CONFEDERATED TRIBES OF WARM SPRINGS

DEPARTMENT OF NATURAL RESOURCES
P.O. BOX C
4223 HOLLIDAY STREET
WARM SPRINGS, OREGON 97761
(541) 553-2001/2002/2003
(541) 553-1994 FAX

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FAX MEMO

****

TO: Kathleen Feehan FROM: Rowlin Richardson

CO/DEPT: _____ PHONE#541-553 7004

PHONE#: _____

FAX #: (541) 276-0540

DATE: 8/21/08

RE: CTWS MEMO SUPPORTING 175 2/day

****

MESSAGE:

If you could present this for CTWS that would be great!

Thanks,

[ ] URGENT [ ] FOR REVIEW [ ] PLEASE COMMENT [ ] PLEASE REPLY [] RECYCLE

RECEIVED 8/21/08 3:40 PM

Item O Handout

Oregon Environmental Quality Commission

Fish Consumption Standards
Oregon Association of Clean Water Agencies
22 August 08

Chair Blosser and Members of the Commission:

I am Charlie Logue, a Board member of the Oregon Association of Clean Water Agencies (ACWA). ACWA is a private not-for-profit organization of Oregon wastewater treatment and stormwater management utilities, along with associated professionals. Our 118 statewide members are focused on protecting and enhancing Oregon's water quality.

ACWA has been involved in the issues surrounding fish consumption rates for many years, and we appreciate our continuing discussions with you.

As ACWA members including myself and Peter Ruffier have shared with the EQC in our presentations before the Commission on this issue over time, ACWA has long advocated that an increase in the Oregon fish consumption rate should focus on true toxic reduction to reduce human health risk to Tribal members and all Oregon fish consumers.

We have had many discussions with Tribal governments, DEQ and EPA staff, and others regarding the implementation of an increased fish consumption rate, and look forward to continuing to contribute to a rule package for EQC adoption. We are committed to an increased fish consumption rate and resulting revised a water quality standard that is implementable by Oregon communities. Items such as water quality trading, effective use of pollution prevention programs, provisions for metals in drinking water intake water, and other ideas are all excellent concepts to evaluate in crafting a fish consumption rate that is implementable.

It is important for the Commission to recognize that at the fish consumption rate being contemplated (175 grams per day), some water quality standards will be set below detection levels. The proposed rules incorporating an increased fish consumption rate must be adequately detailed to provide the Department, Tribal governments, permit holders, and the public, clear information about how complex technical permitting issues will be handled.

We would advocate the EQC provide additional direction to DEQ on two important additional elements to be incorporated in the fish consumption rate rule making process.

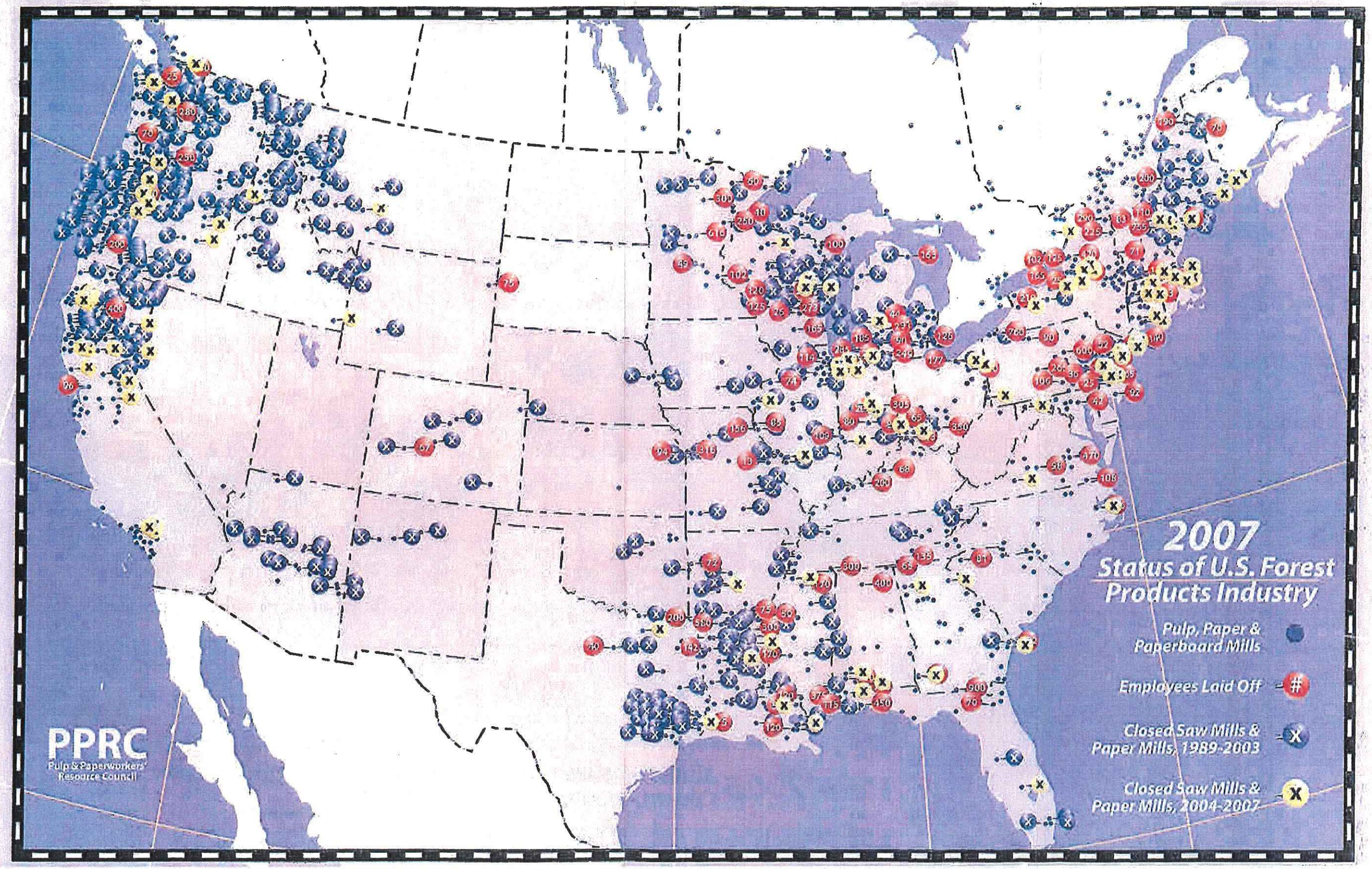
One, coordinate the fish consumption rate rule making efforts and the SB 737 requirements to prioritize and reduce Persistent Bioaccumulative Toxics for Oregon.

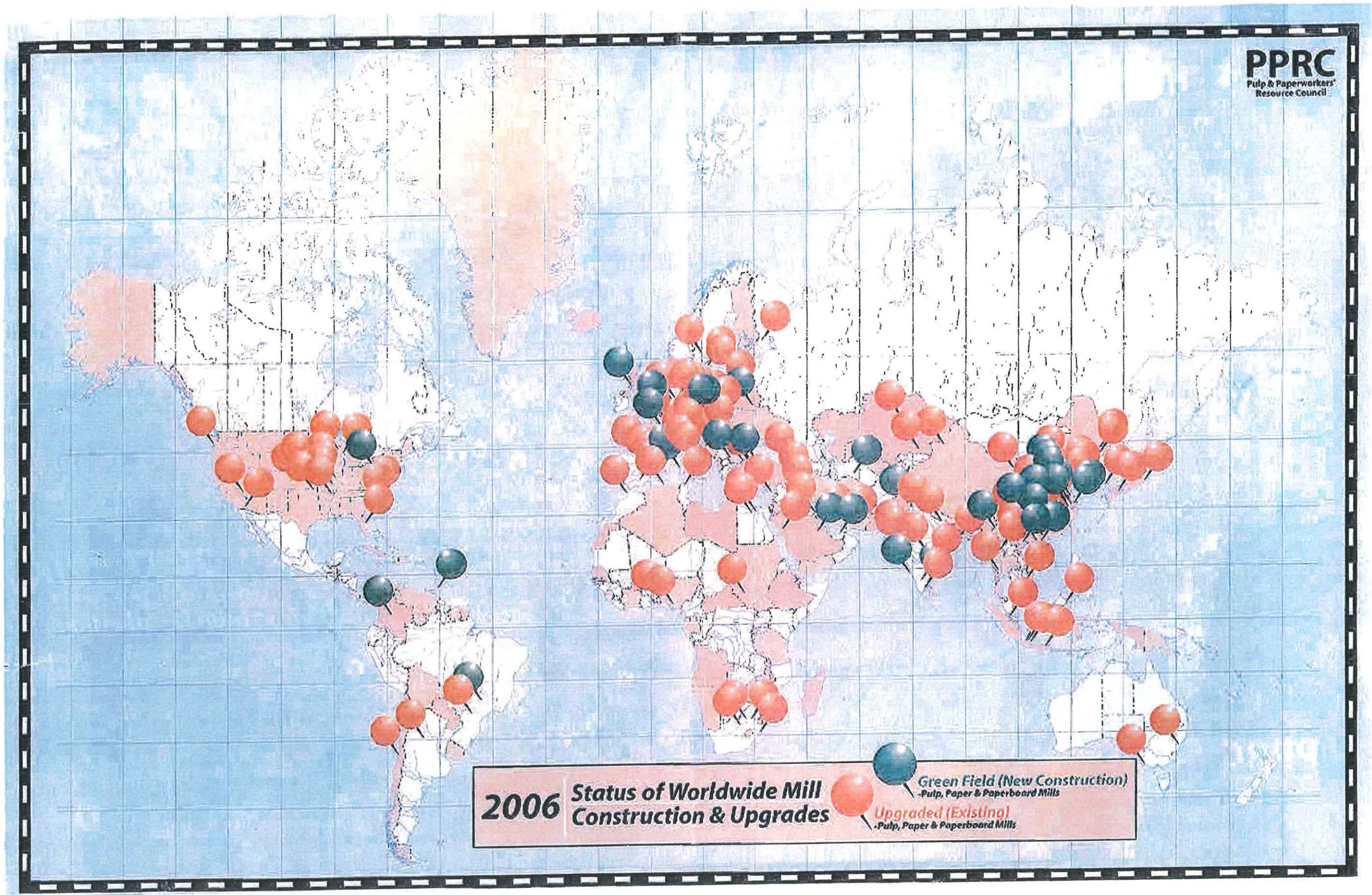
Secondly, the Commission should be using the energy and attention of this process to focus on true toxics reduction. A comprehensive integrated toxic reduction strategy that focuses the current environmental authorities on reducing the toxics of greatest risk for fish consumers should accompany the increased fish consumption rule adoption. We would be glad to share our specific ideas on toxic reduction programs at the appropriate time.

Thank you for your time, and I would be glad to answer any questions.

Handout from Mike Sullivan, Oregon Association of Western Pulp and Paper Workers

Public Forum speaker, August 2008 EQC meeting




PPRC
Pulp & Paperworkers' Resource Council
2006
Status of Worldwide Mill Construction & Upgrades
Green Field (New Construction)
-Pulp, Paper & Paperboard Mills
Upgraded (Existing)
-Pulp, Paper & Paperboard Mills