2. NEED FOR A TMDL

A. Overview

The Columbia River and segments of the Snake and Willamette Rivers are currently water quality-limited due to the presence of excessive levels of 2,3,7,8-TCDD. This pollutant is the most toxic of a group of compounds known as polychlorinated dibenzo-para-dioxins (dioxin). The concern over dioxin levels in the Columbia River is based on data describing concentrations of 2,3,7,8-TCDD in effluents and treatment plant sludges at chlorine-bleaching pulp mills as well as in fish tissue below these mills.

Section 303(d)(1)(C) of the Clean Water Act (CWA) and EPA's implementing regulations (40 CFR Part 130) require each state to identify waters for which existing required pollution controls are not stringent enough to attain applicable water quality standards. For these water quality-limited segments, each state is then to establish total maximum daily loads (TMDLs) for appropriate pollutants of concern. By definition (40 CFR, § 130.2), a TMDL is the sum of the individual waste load allocations (WLAs) for point sources and load allocations (LAs) for nonpoint sources and natural background. The CWA states that the TMDL:

> *"shall be established at a level necessary to implement the applicable water quality standards with seasonal variations and a margin of safety which takes into account any lack of knowledge concerning the relationship between effluent limitations and water quality."*

Thus, the TMDL is effectively an implementation plan for achieving water quality standards using an appropriate margin of safety. A margin of safety may be provided (1) by using conservative assumptions in the calculation of the loading capacity of the waterbody and (2) by establishing allocations that in total are lower than the defined loading capacity. The water quality standard being protected by this TMDL is 0.013 parts per quadrillion (ppq) 2,3,7,8-TCDD in the water (see Appendix A).

The national focus on toxics discharges as evidenced in the 1987 amendment to Section 304 of the CWA, 33 U.S.C. § 1314(l), gives additional urgency to the establishment this TMDL. Congress intended § 304(l) to focus state water quality protection programs on immediately addressing water quality problems due to point source discharges of toxic pollutants. States are required to develop lists of impaired waters, identify point sources and amounts of toxic pollutants they discharge,and to develop individual control strategies (ICSs) for each such point source. An ICS may be a draft or a final National Pollutant Discharge Elimination System (NPDES) permit. The § 304(l) lists developed for Washington, Oregon, and Idaho have identified dioxin levels in the Columbia, Snake, and Willamette Rivers as exceeding applicable water quality standards. Limits included in ICS's, developed under § 304(l), must be consistent with waste load allocations (WLAs) where a TMDL has been established.

B. The Concern

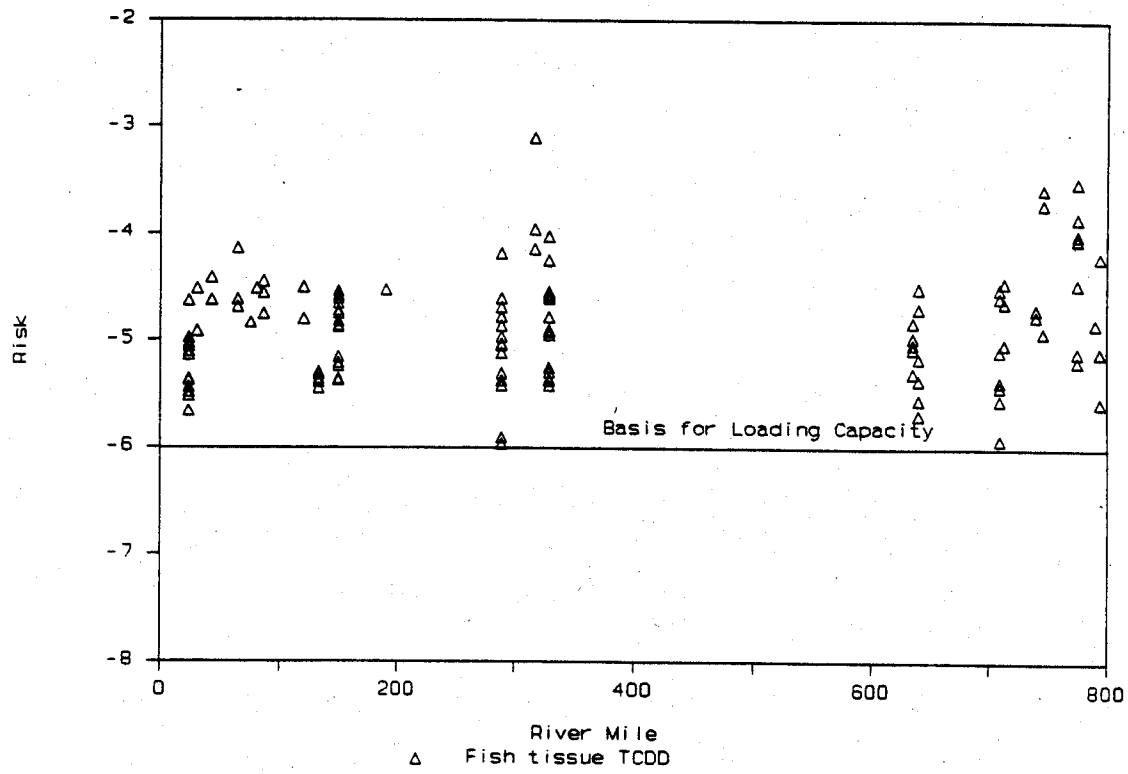
Dioxins are produced as a result of human activities, such as the manufacture of chlorinated herbicides, the combustion of domestic and industrial wastes, and the production of chlorine-bleached wood pulp. Both water column concentrations of dioxin in the Columbia River and the water quality standard for 2,3,7,8-TCDD are below levels which can be measured with current analytical technology. However, because some organisms, such as fish, accumulate dioxin in their bodies, 2,3,7,8-TCDD has been found at detectable levels in the tissue of fish taken from the Columbia River basin. As discussed below, these tissue levels are of concern and indicate that these waters exceed state water quality standards.

The state water quality standard applicable to 2,3,7,8-TCDD in the Columbia River basin has been determined to be 0.013 ppq (see Appendix A). The EPA criterion on which this standard is based was derived from human health concerns resulting primarily from consumption of contaminated fish. In establishing EPA's 1984 2,3,7,8-TCDD criterion values, the following factors were developed and used: a bioconcentration factor (this relates the concentration in fish tissue to the concentration in the water in which the fish lives), fish consumption rates, and a cancer potency factor. These factors relate water column concentrations to fish tissue concentration and cancer risk. A fish tissue concentration of 0.07 ppt and a water concentration of 0.013 ppq (the applicable water quality standard) are both estimated to result in a life-time cancer risk of 10^{-6} (one excess cancer per one million people).

In 1987, EPA initiated a National Bioaccumulation Study (NBS) designed to gather screening information on the prevalence and concentrations of selected toxic compounds in fish tissue and other aquatic organisms. This study was conducted on a broad scale across the United States and included testing for 2,3,7,8-TCDD. Sampling sites included relatively undisturbed background areas, streams below industrial, agricultural, and urban activities, and segments below mills using chlorine to bleach pulp. The NBS identified concerns related to chlorine-bleaching kraft pulp mills. Fish samples collected at several locations below chlorine-bleaching pulp mills on the Columbia River within EPA Region 10 (from the Canadian border to the mouth) have shown detectable concentrations of 2,3,7,8-TCDD. Another EPA study, the "104 Mill Study" (1988), subsequently confirmed, through testing of effluents and sludges, that chlorine-bleaching pulp mills are a significant source of 2,3,7,8-TCDD.

Figure 2-1 displays estimates of risk of excess cancer resulting from consumption of fish at various locations along the length of the river. The risk estimates were obtained by applying the fish consumption and cancer potency factors used in developing the EPA criterion for 2,3,7,8-TCDD to fish tissue concentrations actually measured. Fish tissue data used came from EPA's National Bioaccumulation Study (1987), the Northwest Pulp & Paper Associations's Columbia River Fish Study (Beak Consultants, 1989), the Washington Department of Ecology's work on Lake Roosevelt (1989-1990), and from efforts in Canada. The resulting risk estimates (Figure 2-1) are consistently higher than the 10^{-6} level, confirming that the water quality standard and, therefore, the loading capacity of the system, are being exceeded. This is consistent with, and supported by, predicted water column concentrations of 2,3,7,8-TCDD (based on in-stream dilution of pulp mill discharges as measured in the 104 Mill Study) which also exceed the water quality standard.

Figure 2-1. Columbia River Fish Tissue Data



C. Water Quality-limited Status

Oregon has identified the Columbia River (river miles 0 - 309) and the Willamette River (RM 0 - 187) as being water quality-limited for 2,3,7,8-TCDD. Washington has similarly identified the Columbia and Snake Rivers within that state as being water quality-limited for 2,3,7,8-TCDD. The state of Idaho has also identified the confluence of the Clearwater and Snake Rivers as being water quality-limited for 2,3,7,8-TCDD. On June 14, 1990, EPA approved these listings pursuant to CWA Section 303(d).

On March 21, 1990 the states of Oregon, Washington, and Idaho stated that they would not adopt a TMDL for dioxin in the Columbia River as state actions but rather requested that EPA establish this TMDL as a federal action. The states acknowledged that while the development of a TMDL has been a cooperative effort, the interstate nature of the Columbia River Basin and the desirability of consistency and equity in regulating dischargers in this basin necessitated that the TMDL be a federal action. Therefore, on June 14, 1990, pursuant to Section 303(d), EPA formally disapproved the expressed intent of Washington, Oregon, and Idaho to not submit TMDLs and, subsequently, developed this final TMDL for dioxin discharges to the Columbia River basin as a federal action.

This TMDL provides a framework to control 2,3,7,8-TCDD discharges to the Columbia River Basin and achieve compliance with water quality standards. The following sections of the decision document describe the established TMDL and the process used to develop it.