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PCBs TMDL DEVELOPMENT

Lake Allatoona, Cherokee, Cobb and Bartow Counties

Introduction:

Section 303(d) of the Clean Water Act and EPA's Water Quality Planning and Management Regulations (40 CFR Part 130) require states to develop total maximum daily loads (TMDLs) for their water bodies that are not meeting designated uses under technology-based controls for pollution. The TMDL process establishes the allowable loadings of pollutants or other quantifiable parameters for a water body based on the relationship between pollution sources and in-stream water quality conditions, so that states can establish water-quality based controls to reduce pollution from both point and nonpoint sources and restore and maintain the quality of their water resources (USEPA, 1991).

General Steps to the PCBs TMDL Development

Step 1. Problem Definition

Objective: *Identify the background information and framework for specific TMDL-listed water that will guide the TMDL development process.*

Georgia has one of the most extensive fish tissues monitoring programs in the Southeast. This is not because Georgia has highly contaminated fish, but because the DNR has made a serious commitment to evaluate fish quality and provide detailed information to the people of Georgia. Fishing is a valuable activity to Georgia's citizens and some people bring their catch to the dinner table. Unfortunately, some fish from a few water bodies in Georgia contain substances, which prohibit safe consumption in limited quantities. This is based on the collection and analysis of fish samples by the DNR to provide information to Georgia fisherman. The program includes analyzing fish tissue samples for 43 different substances including metals, organic chemicals and pesticides. Of these 43, only polychlorinated bi-phenyls (PCBs), PCBs and mercury have been found in some fish tissue samples at concentrations which could create a long term, unlimited quantity fish consumption problem on a risk based assessment basis.

This information is included in "Georgia 1997-98 Freshwater & Saltwater Sport Fishing Regulations"; in "Guidelines for Eating Fish from Georgia Waters - 1997" and in the Georgia's 1996 305(b) Water Quality Report. These publications are updated annually or every two years to reflect new information. In addition, a number of the waterbodics have been listed on the CWA Section 303(d) list which is submitted to the US EPA every two years. The CWA Section 303(d) list shows these waters with the problem issue being Fish Consumption Guideline or FCG. The FCGs were designed to protect from experiencing possible health problems associated with fish consumption. It is important to keep in mind that FCGs are based on eating fish with elevated PCB or PCBs levels over a period of 30 years or more. The use of PCBs was banned in the United States in the late 1970s.

Step 2. Target Identification

Objective: *Identify numeric or measurable parameter target values that can be used to evaluate the TMDL and restoration of water quality in the listed water body.*

The endpoint or goal of these TMDLs is to reach a point where Fish Consumption Guidelines can be removed due to a satisfactory risk based assessment and the waterbodies have no restrictions. One way to measure this goal is to determine relationship between fish tissue contamination levels and water column concentrations, then compare the water column concentrations to existing EPA criteria. The EPA water column criteria will be the target for this TMDL development. For PCBs the EPA criteria is 0.000045 ug/l based on the consumption of organisms only.

Step 3. Source Assessment

Objective: *Characterize type, magnitude, and location of sources of PCB loading to the water body.*

It is now illegal to manufacture, distribute or use PCBs in the United States; however in the past these synthetic oils were used regularly as fluids for electrical transformers, cutting oils and carbonless piper. Although they were banned in 1976, they do not break down easily and remain in lake and river sediments for years. Over time levels of PCB contamination will decrease.

Step 4. Linkage Between Numeric Targets and Sources - Model Development

Objective: Define a linkage between the selected targets and the identified sources. The linkage or model is defined as the cause and effect relationship between the selected endpoint and the identified sources. This linkage can be derived from data analysis, best professional judgment, and previously documented relationships. The linkage or model is used in determining what loading is acceptable to achieve the target value.

PCBs got into water as a result of stormwater runoff and nonpoint source pollution. When it rained, PCBs on to land was washed into the water and was carried downstream by rivers and creeks into lakes and reservoirs. Contaminants got into fish in a variety of ways. Fish absorb PCBs from either water, suspended sediments or in their food.

PCBs in the waterbodies are decreasing over time due to a combination factors, including sediment being flushed out of the waterbodies, contaminated sediment being buried and the water column concentrations being volatilized. Contaminant decay rates can be estimated from monitored data of the waterbodies impacted in Georgia and from data collected elsewhere

The model is essential to defining a relationship between the source and the impact on the receiving water. Using the monitoring data available and historical relationships, the linkage between PCBs loading and exposure concentrations and natural die-off in the environment can be accomplished by comparing historical records of load and exposure concentrations empirically.

O'Connor in 'Toxic Substance Wasteload Allocation Seminar Notes, Manhattan College, 1982" presented an equation relating water column toxic concentration to other ambient conditions, including suspended solids, flow, loadings of toxics, etc. Based on this relationship (equation 9, page 6-6), under steady state conditions, if the loading of toxic materials is removed the water column concentration of this toxic will, over time, be zero. For PCBs in Georgia Lakes, the PCBs loadings have been removed or reduced to zero. Examination of the PCBs data available, for Georgia, in STORET shows a decreasing trend of PCBs concentrations in water column, sediments and fish tissues.

The time it will take for PCBs to be removed from the reservoir system can be calculated by determining the removal rate of PCBs from the reservoir. This removal rate is dependent on the flow, volume and depth of the reservoir, suspended solids concentration, concentration of PCBs, settling velocity, resuspention velocity and toxic decay coefficient. See O'Connor, page 6-14. For this reservoir the removal rate is conservatively estimated at 0.05/year or a 5 percent reduction per year. This is consistent with the state-wide decreasing trends, previously noted.

The bioaccumulation factor (BAF) is the relationship between concentration in the fish tissue (Cf) and concentration in the water column (Cw). BAF = Cf / Cw. An estimates for BAF for PCBs was made based on "Great Lakes Water Quality Initiative Technical Support Document for the Procedure to Determine Bioaccumulation Factors – EPA, March 1995". The BAF for trophic level 4 and a 3.10% lipid is 31,200 l/kg based on EPA Criteria values. Using this BAF and EPA's water column criteria the acceptable fish tissue concentration is 0.014 mg/kg.

For both water column concentration and fish tissue concentration it is estimated it may take 10 to 20 years to flushed out of the reservoir and the TMDL target to be met.

Step 5: TMDL Development

Total maximum daily loads (TMDLs) are comprised of the sum of individual wasteload allocations (WLAs) for point sources, and load allocations (LAs) for both nonpoint sources and natural background levels for a given watershed. The sum of these components must not result in the accidence of water quality standards (WQSs) for that watershed. Conceptually, this definition is denoted by the equation:

$$TMDL = \Sigma\, WLAs + \Sigma\, LAs$$

The TMDL is the total amount of pollutant that can be assimilated by the receiving water body while achieving water quality standards. TMDLs establish allowable water body loadings that are less than or equal to the TMDL and thereby provide the basis to establish water-quality-based controls.

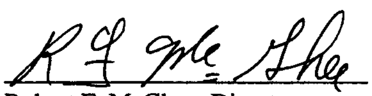
Since the impairment (FCGs duc to PCBs) is due to a pollutant not legally used in the State of Georgia and there are no known discharges of these chemicals, for the waterbody, the Load Allocation is equal no WLA and no nonpoint point source discharge. At the present time a background source of PCBs is being transmitted to the water column due to historic past practices. However the concentration is decreasing over time, in 10 to 20 years the loading rate is expected to decrease to levels that will not be a water quality problem.

The TMDL for this waterbody is zero point or nonpoint source loading, recognizing the fact that historic sediment background concentrations of PCBs will contribute to the water column and fish tissue contamination until the sediments are buried or flushed out of the system. The result of no restrictions on consumption of fish due to PCBs it is estimated to occur over the next 10 to 20 years.

The State DNR will continue a progressive sampling program to evaluate problem areas and to protect public health by giving people the information they need to make decisions about eating fish from Georgia waters. Since contaminant levels in fish decrease very slowly, sampling the same species of fish from the same locations over time will allow DNR to document changes and trends in contamination levels. These data and trends will continue to be reported in the Georgia 305(b) report.

The Georgia DNR has made the commitment to protecting the state's rivers, streams, lakes and other waters. Both PCBs and Chlordane have been banned, there are no new sources, and over time the levels of these contaminants are expected to decrease to a level to allow fishing with no restrictions.

FINAL AGENCY ACTION



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