

**OFFICE MEMO**

<b>TO:</b>  Dr. Paul Hutton, PhD.	<b>DATE:</b> May 17, 2001
<b>FROM:</b>  Bruce Agee	<b>SUBJECT:</b>  Estimated DOC/TOC Ratios For Modeling Purposes

The MWQI program has been collecting dissolved organic carbon (DOC) and total organic carbon (TOC) data since 1986. Although DOC data is available for the entire time period, TOC was measured mostly at during the 1980's and since 1997. You asked if we could develop an estimate of TOC based on historical ratios between TOC and DOC in our data set.

#### Historic DOC/TOC Ratio

I reviewed the data from four regional perspectives:

1. American, Sacramento, and San Joaquin Rivers,
2. Agricultural Drain Stations,
3. Non-Agricultural Drain Stations, and
4. Selected Old and Middle River Stations

Because DWR recently changed the method of analysis of TOC from wet oxidation to combustion, I used only that data analyzed before November 1, 2000. A summary of this work is included in the attached Excel File titled TOC\_DOC\_Comparison.xls.

I estimated DOC/TOC ratios by two methods. In the first method, I divided the average DOC by the Average TOC for all data in the group.

The second method was initially developed for the agricultural drain data. The agricultural drain data was the most challenging because organic carbon values ranged from about 3 mg/L to 119 mg/L. Data in the other groups typically ranged from 3 mg/L to 5 mg/L. I was concerned that the high organic carbon numbers would tend to overpower the low numbers in the grand average. To deal with this, I summarized average DOC and TOC by month and by drain (i.e. up to 12 monthly averages per drain). This tended to group carbon data into narrow ranges. I then computed the average of the DOC/TOC ratios. I repeated this method for all of the regional groupings for consistency. Since DOC cannot exceed TOC, all ratios greater than 1 were rounded to 1.

Based on my calculations, the DOC/TOC ratio for all regional groupings should be 1.

#### Combustion Method TOC

Bryte Lab recently changed the method of analysis for TOC to the combustion method (TOCox). The reason for the change is that the wet oxidation method does not do a good job of converting particulate organic carbon into a form detected by the analyzer. While the two methods provide virtually identical results for DOC, they can differ significantly when analyzing for TOC. The greater the amount of particulate organic carbon present, the greater the difference between the results by the two methods.

In an attempt to show how future DOC/TOC estimates may change, I estimated DOC/TOCox for some of the MWQI data and have included these estimates in the spreadsheet. Since the combustion method TOC was only introduced in February, 2000, there are only about 5 months of data to evaluate.

Generally, DOC/TOCox ratios range from 0.9 to 0.26. The six month average for the American, Sacramento and San Joaquin Rivers is about 0.6.

I did a similar analysis using Barker Slough at the North Bay Aqueduct data. This location was chosen because it is the most turbid site we currently monitor. I used data collected since February, 2000 because the TOC oxidation method was improved and did yield improved results from February on. Data collected from November to present was by the combustion method. The monthly average DOC/TOCox ratios at Barker North Bay range from about 0.6 to about 1.0. These results should not be used for input into the model, only to give a feel for how future refinements to the model might look.

#### Recommendations

I recommend that the MWQI program continue collecting both DOC and TOC measures. They should also conduct a study of active agricultural drains to determine a reasonable estimate of DOC/TOCox. This study should cover at least 12 calendar months and include at least one representative drain from the high, medium, and low organic carbon producing regions in the Delta.

If you have any questions about this work, please contact me at (916) 327-1677.

-- Bruce