

Concentration versus TEQs

Many of those associated with the Maine dioxin monitoring program are focused on human health and the use of TEQs as part of that assessment. While this is entirely appropriate for human health assessments it is not necessarily the best approach for ecological evaluations or source identification. Important source information is lost when using a toxicity normalization that obscures the concentration of the individual congeners that is necessary to establish the chemical fingerprint associated with a particular source. This chemical fingerprinting approach is particularly important in the use of a gradient design for purposes of source identification. While it might also be informative to evaluate sources on a TEQ basis, that is not the most efficient method for source identification and chemical fingerprinting.

This focus on TEQs has also influenced the perception regarding the percent composition of pulp mill effluents. There are several confounding factors in these analyses. Among them is the fact that each mill probably has a unique signature and it may be inappropriate to assume that some national average based on an EPA survey conducted 8-10 years ago accurately represents a particular mill. Furthermore, with the recent advances in mill process technology it is likely that the composition has changed.

Although the caged mussel data suggest that the SAPPI mill could be a source of OCDD, based on the decreasing chemical gradient with distance from the mill, many reviewers have rejected this observation on the assumption that OCDD is not part of the pulp mill signature. We will let the data speak for themselves but the data are the data and we are looking for the most reasonable explanation.

In our view, the most likely explanation is that the SAPPI mill is probably discharging OCDD. Some of those refuting this explanation have used a graph from the dioxin reassessment (Chapter 1, page 1-53) to suggest that the typical mill signature is approximately 70% 2,3,7,8-TCDD 20% 2,3,7,8-TCDF, and approximately 1% OCDD. Although the graph is not clearly identified, it represents the percentage composition on a TEQ basis and not a concentration basis.

This issue is clarified in chapter 8 page 8-87 which presents the same graph clearly labeled as on a percentage TEQ basis. More importantly, the other graph shows the percent congener distribution on a concentration basis. These results are quite different. OCDD makes up approximately 40% of the total dioxin-furan concentration, 2,3,7,8-TCDF about 15%, and 2,3,7,8-TCDD only about 5%. These graphs are shown on the following page.

It is also important to emphasize that the congener distribution has likely changed over the past 10 years and the concentrations of the most toxic congeners (2,3,7,8-TCDD and 2,3,7,8-TCDF) have likely diminished even further. This is one of the reasons why we did not assume any specific congener contribution, we emphasized the use of concentrations rather than TEQs, and we used Total concentrations for some of the comparisons. We never advocated the use of totals for regulatory purposes, it was just a means to an end in order to characterize and understand processes. We believe that we have been successful in increasing the understanding and providing important information that would never have been obtained through fish monitoring.

If we assume for the sake of argument that the predicted congener distribution on a congener basis is 40%:15%:5% (8:3:1), based on a rough approximation from the graph in the dioxin reassessment we can compare the predicted ratio with the concentrations measured in mussels and the detection limits to see if the numbers are reasonable. The measured ratio at Station 5 closest downstream station to the mill, is 4:0.04:0. While the measured ratio of 10:1 for OCDD versus 2,3,7,8-TCDF is reasonable to the predicted ratio of 8:3, it also seems reasonable based on mill-specific differences in mill process differences and the possibility that process changes have raised this ratio over the years. Furthermore, if we believe the 2,3,7,8-TCDF measurement of approximately 0.04 2,3,7,8-TCDF, and a ratio to 2,3,7,8-TCDD of 3:1, it is also reasonable that measurements of 2,3,7,8-TCDD would be below the detection limits.

