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## THE USE OF TOXIC EQUIVALENCY FACTOR DISTRIBUTIONS IN PROBABILISTIC RISK ASSESSMENTS FOR DIOXINS, FURANS, AND PCBs

**Brent L. Finley**

Exponent, Inc., Santa Rosa, California, USA

**Kevin T. Connor**

Exponent, Inc., Natick, Massachusetts, USA

**Paul K. Scott**

BB&L Sciences, Pittsburgh, Pennsylvania, USA

*Toxic equivalency factors (TEFs) for 2,3,7,8-substituted polychlorinated dibenzo-p-dioxins (PCDD) and dibenzofurans (PCDFs) and coplanar polychlorinated biphenyl (PCB) congeners have been developed by the World Health Organization (WHO). Each TEF was derived from a range of relative potency (REP) estimates obtained from in vivo and in vitro studies wherein the potency of the congener was evaluated relative to 2,3,7,8-TCDD (or some other appropriate benchmark). For most congeners, the range of REP values spans several orders of magnitude, and the degree of conservatism varies widely among the congeners. Although some TEFs are greater than the maximum REP value, others are less than the minimum. This suggests that the point estimate TEFs introduce a significant amount of variability and uncertainty into the PCB and PCDD/F risk assessment process. The use of REP data distributions, rather than point estimate TEFs, would permit a more informed evaluation of the variability and uncertainty in the attendant risk estimates. Further, a standardized method of choosing a TEF from an REP distribution would ensure a uniform degree of conservatism in the TEF values. In this analysis, distributions of REP values were derived for the coplanar PCBs and 2,3,7,8-substituted PCDD/Fs. There are 936 REP values in the WHO database; the number of values per congener ranges from 1 (1,2,3,7,8,9-HxCDF) to 117 (PCB126). Twenty REP values qualified by WHO as "<" were replaced with one-half the stated value; 65 values qualified as ">" were not used. Fit tests indicate that most distributions are lognormal. Mean, standard deviation, and 50th and 95th percentile values for each REP distribution are presented. In general, the WHO TEFs for the PCDD/Fs are at the upper bound (75th percentile or greater) of the underlying REP distributions, while the PCB TEFs tend to be more representative of the central tendency of the underlying REP distribution. A simplistic weighting scheme that emphasizes long-term in vivo studies suggests that the REP distributions may not be overly sensitive to weighting techniques—that is, the statistical descriptors of the weighted distributions were similar to those of the unweighted distributions. A case study using fish tissue PCB and PCDD/F data suggests that in some settings the use of WHO TEFs may understate upper bound PCB risks relative to PCDD/F risks. A preliminary sensitivity analysis suggests that measurement endpoint, tissue-type and species (or*