

How Source Location, Population Distribution, and Pollutant Travel Distance Affect Exposure Estimates for Pollution Prevention

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Human Toxicity Potential (HTP) has been used in life-cycle impact assessment (LCIA) to assess the potential health impact of pollutant releases linked to the life-cycle of a product or service. HTP accounts for both the inherent toxicity and exposure expressed as potential dose. Potential dose has been calculated using a fate and exposure models applied to generic environments. One concern about this approach is how well a generic environment accounts for actual emissions/exposure patterns. Of particular concern is the failure to account for the correlation of emissions magnitude and population density and for the variation in spatial range or characteristic travel distance (CTD) among different pollutants. To address these concerns, we have developed a modified version of the HTP that accounts explicitly for where emissions occur, the CTD of the pollutant, the population within a pollutant's CTD, and the intake fraction within the CTD. We compare these revised HTP calculations with earlier calculations based on a generic environment. In the revised approach, we use the US EPA Toxic Release Inventory (TRI) data to identify both the quantity and location of emissions. We use the CalTOX multimedia model to calculate for each release the CTD and the individual intake fraction, $iF(i)$. $iF(i)$ is defined as the integrated incremental intake of a pollutant by a random individual within one CTD, occurring at any time, per unit quantity of pollutant emitted from a specified source or source class. We use US Census data to determine the size of the population within one CTD of a TRI release. A population-based HTP is calculated from the product of amount released, individual intake fraction, population exposed, and inherent toxicity. The HTP is then aggregated within a geographical region--urban region, country, continent, etc. We have used this process to identify those factors that account for significant differences between the existing and revised HTP values.