BNL-63549

AN EMPIRICAL STUDY OF INDICATORS FOR SENSITIVITY OF O_3 FORMATION TO NO_X AND REACTIVE ORGANIC GASES IN THE NASHVILLE URBAN PLUME

J. H. Lee, P. H. Daum, J. Weinstein-Lloyd, L. Nunnermacker, S. R. Springston, X. Zhou, and L. Newman

American Geophysical Union 1996 Fall Meeting, San Francisco, CA, Dec. 15-19, 1996.

The photochemical regime for O_3 production in the Nashville urban plume was examined using the concentration ratio (total-peroxide/NO_z) as an indicator of whether the O_3 production rate was limited by the availability of NO_x, or reactive organic gases (ROG). (Simple photochemical calculations have shown that the transition from NO_x to ROG limited conditions occurs at a total-peroxide/NO_z ratio of 0.5.) In downwind transects of the Nashville urban plume, it was generally observed that the O_3 formation rate had a tendency to be sensitive to NO_x concentrations at plume edges (total-peroxide/$NO_z \geq$ 0.5) and to ROG at the plume center (total-peroxide/$NO_z \leq 0.5$), consistent with both the higher NO_x concentrations, and the higher NO_x to ROG ratio observed in the center of the plume relative to its edges. The transition points between NO_x and ROG sensitivity for other indicator species ratios (e.g., O_3/NO_z, O_3/NO_y, H_2O_2/NO_z, CH_2O/NO_y) were calibrated against the transition point for the ratio (total-peroxide/NO_z) for one of the flights. Calibrated in this way, other indicator species ratios were found to be equally effective in predicting NO_x or ROG sensitivity for all of the flights. Systematic variation of these indicator ratios in the Nashville plume as it advected downwind of the urban center was found to have implications regarding the most effective strategy for controlling O_3 in the Nashville region.

Research by BNL investigators was performed under the auspices of the U.S. Department of Energy under Contract No. DE-AC02-98CH10886.