# LONG-PATH AMBIENT-AIR MONITORING WITH TUNABLE DIODE LASERS*

E. D. Hinkley and R. T. Ku
Lincoln Laboratory, Massachusetts Institute of Technology
Lexington, Massachusetts 02173 U.S.A.

## ABSTRACT

Most pollutant gases have characteristic spectral lines in the 2- to 20-μm region of the infrared, and consideration is being given to the use of laser spectroscopic techniques to measure their concentrations in the atmosphere by resonance absorption. Tunable semiconductor diode lasers, by virtue of their small size and simplicity of operation, have been used for preliminary long-path monitoring experiments involving the detection of $C_2H_4$, CO, and water vapor. Utilization of a closed-cycle cryogenic cooler requiring only electrical power has eliminated one of the major drawbacks of this type of tunable laser -- i.e., the need for liquid helium. The effects of atmospheric turbulence have been reduced by derivative techniques. In one of the experiments to be described, radiation from a $PbS_{0.82}Se_{0.18}$ diode laser was collimated and directed over a 610-meter path, and ambient levels of CO were detected with 2.5-ppb sensitivity. Assuming a 0.3% detectability of absorption, one can project sensitivities in the low ppb region for most gases when a path length of 2 km is used.

---

* This work was supported by the National Science Foundation (RANN) and the U. S. Environmental Protection Agency.