LIDAR OBSERVATIONS OF RAMAN SCATTERING FROM SO_2 IN A POWER PLANT STACK PLUME

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ABSTRACT

LIDAR techniques have been successfully applied to the detection of the Raman backscatter from SO_2 in the plume of a 200 megawatt coal-burning electrical-generating plant from a distance of 210 meters. The LIDAR system used consists of a 61 cm diameter, f/4 Newtonian telescope and 1.0 - 1.5 joules-per-pulse, 1 pulse-per-second ruby laser. Narrow band interference filters are used to select the 7546A ν_1 vibrational line of SO_2. The signal from a photomultiplier tube was sequentially applied to each 254 nsec wide channel of a 15-channel photon counting system, resulting in a direct correlation between channel number and range increment. Photon counts were accumulated from the backscatter of a number of laser pulses (typically 50 or 100), and the accumulated counts per channel printed on paper tape.

One sequence of measurements was made during a two-hour period while the plant electrical output was being reduced by approximately 50%. Although the Raman system had not been quantitatively calibrated, the LIDAR data correlated well with the varying plant electrical output. N_2 scattering observations were also made and an approximate quantitative SO_2 concentration obtained by ratioing the SO_2 data to N_2 data. This ratio compared well to the in-situ measurements made during the same period by Environmental Protection Agency sampling instruments.