

were selected as indicator plants. Information thus developed was used by the biologists in periodic surveys and special studies of the effect of plant emissions on vegetation. Surveys were supplemented by chemical analyses of foliage to measure any elevation of sulfate which might have occurred.

Soon after our dispersion studies were initiated at the Johnsonville Plant, it became apparent that conventional sampling methods would not be practicable, primarily because of limitations of mobility. To overcome this limitation, TVA developed a technique for use of a helicopter for measuring SO_2 concentrations, both aloft and near ground elevation. The technique was subsequently refined to permit accurate measurements of plume rise above the top of the stacks and of plume SO_2 concentrations and geometry at various distances from the plant. The technique was used in the recently completed TVA-Public Health Service cooperative research project which included a full-scale study of dispersion of power plant gases.

Since the TVA plants generally are located in areas remote from other sources of SO_2 , our findings from our air pollution studies should be representative of the stack gas distribution pattern for modern coal-fired power plants. In view of this, a brief review of air pollution experience at TVA power plants as documented by extensive monitoring experience may be of special interest.

STACK PERFORMANCE

Data obtained from routine monitoring and from full-scale dispersion studies have been utilized in estimating stack height requirements for TVA power plants. Post-operational monitoring data for each plant have been used to check stack performance and indicated adjustments have been made in stack height calculations for new plants. Until the recent completion of our full-scale dispersion study, principal reliance in stack height calculations was upon formulas derived empirically from monitoring data.

Dispersion coefficients determined by the TVA full-scale dispersion studies and plume rise data derived from extensive field measurements have improved our ability to estimate stack performance for large thermal power stations.

Estimated maximum ground level concentration of SO_2 as computed by procedures presently used is not an absolute maximum, but rather a value which TVA experience indicates will not be equaled or exceeded at any one point in the vicinity of the plant (assuming no other SO_2 sources) more than 0.01 percent of the time—that is, approximately two 30-minute periods a year. When exceeded, it would not be by more than 25 to 30 percent.

Planning for air pollution control at the Johnsonville Plant included computing stack performance by procedures commonly used at the time. Experience after the plant was put into operation was much more favorable than was predicted on the basis of the earlier computations. Even with improvements subsequently made in methods for computing stack performance, as unit sizes and stack heights have increased, experience has continued to be more favorable than predictions based on calculations, though the margin of difference now is much less than it used to be.

COMPARISON—GROUND LEVEL CONCENTRATIONS OF STACK GASES FROM SMALL OLD PLANTS AND LARGE NEW PLANTS

A comparison of ground level concentrations of stack gases from the Johnsonville Plant with those from Paradise, one of the newer large plants, provides an interesting measure of the progress that has been made in control of air pollution from power plants by dispersion from high stacks. The original Johnsonville Plant was constructed during the period 1949–1953 and consisted of six 112.5-mw units with 170-foot stacks. SO_2 monitoring was initiated in 1951 when the first units were placed in operation. To overcome downwash due to building turbulence and to improve dispersion, the stacks were subsequently raised to 270 feet. Continuous monitoring for SO_2 was conducted at locations in the vicinity of the plant where maximum concentrations were expected to occur. From analyses of SO_2 records before the stacks were raised, the maximum 30-minute average concentration of SO_2 was 3.8 ppm. After the stacks were raised, it was only 0.6 ppm.

The Paradise Plant with two 704-mw units was placed in commercial operation in 1963. This plant has two 600-foot stacks. Despite the fact that average daily SO_2 emission is double that of the original Johnsonville Plant, the maximum 30-