

884. ADEQUACY OF TECHNOLOGY FOR POLLUTION ABATEMENT

to 10,493 in 1962 represents a major reduction in the potential air pollution from this source, since only 46 percent as much fuel is being used per unit of output as was the case 35 years earlier. Further, electrostatic precipitators were commonly employed to clean flue gases in the power industry a generation before the passage of the Clear Air Act of 1963.

PIONEERING EXPERIENCE WITH HIGH STACKS ON THE OVEC AND AMERICAN ELECTRIC POWER SYSTEMS

(By Philip Sporn¹ and T. T. Frankenberg²)

1. INTRODUCTION

In October 1952, the Ohio Valley Electric Corporation (OVEC) undertook the building of two very large plants to serve a new gaseous diffusion plant of the United States Atomic Energy Commission. These plants would be located on the Ohio River, one in southeastern Ohio and the other near Madison, Indiana (1³). The net capacities were originally estimated to be 1,000,000 kw for the Ohio location and 1,200,000 kw at the Indiana site. At that time the ten largest thermal-electric plants in the United States had an average size of less than 600 mw. Both new plants represented difficult assignments from the standpoint of controlling air pollution. Due to the economic availability of coal of rather low quality the plants might burn fuel containing as much as 4 percent sulfur, and would discharge at least twice the amount of sulfur dioxide as any previous plant. Further, their locations in predominantly rural areas insured that any inadequacies in the disposal of the flue gases would be glaringly apparent. Therefore every effort was made to design the plants so that they would have a negligible effect on the ground level concentration of sulfur dioxide after reaching full load operation.

2. PLANNING

Arrangements were made to conduct wind tunnel studies of the site at Madison, Indiana, subsequently named Clifty Creek, since preliminary evaluation of this location indicated that from the aerodynamic standpoint it would present unusual difficulties. In the prevailing downwind direction from the plant, the flood plain is very short followed by an abrupt escarpment-like rise of the terrain to a plateau approximately 350 feet above the plant grade. Situated on this high plateau, at its closest approach to the plant, there is a very popular state park with an inn directly overlooking the plant site. On the same plateau, slightly further removed from the site, there is the Southeastern Indiana State Hospital for mental patients. It was deemed absolutely imperative that the highly concentrated stack plume should not descend on either of these very sensitive areas of habitation under any foreseeable circumstances. The wind tunnel work included the terrain shown in areas A and B of Figure 1, which lay in the most critical direction of the plant.

It was found that if the stack plume intersected the turbulent flow along the sharp rise to the plateau, it would immediately be brought to the ground around the inn. If the stack height was chosen so that the plume could be kept above this boundary layer, then a definite lift of the plume occurred, as shown in Figure 2. This lift varied between 50 and 150 feet and was so obvious in the wind tunnel that an allowance of 50 feet was made for the "ski jump" effect when selecting the stack heights.

3. THEORETICAL DIFFUSION CALCULATIONS

Gas diffusion calculations were carried out to determine the ground level concentrations of SO₂ at distances well beyond those that could be modeled in the wind tunnel. The Bosanquet, Carey and Halton equation (2) was used to calculate a stack gas rise and thus determine the effective stack height. With this calculated, the Sutton equation (3) was used to determine ground level concentration but with somewhat less conservative parameters (4).

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³ Numbers in parenthesis refer to references at the end of paper.