IN 1949, the Tennessee Valley Authority began the construction of the first of its major post-war steam-electric plants now totalling seven in number. These plants were to be coal-fired and would consume large amounts of bituminous coal. Plans were made to initiate a study program before the plants actually went into operation. As the building program was to be staggered over a period of years, this would permit the collection of pre-operational data at each plant. In addition, any results of studies at the first plants could be used in planning measures for control of airborne emissions from new plants or from additions to existing plants.

The first phase of TVA studies was a thorough literature review to identify information that might be applicable to the TVA area. This literature review was accompanied by a survey of the various power plant areas to become familiar with the vegetation and topography around each plant site. The review of the literature and field surveys revealed that although considerable work had been done on the effect of fumes (SO$_2$) on vegetation, very little was directly applicable to the TVA region with the type of program planned. The majority of the work had been done in western Canada and western United States in connection with copper and zinc smelting activities.

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**Surveillance Program**

One of the early needs that had to be met in the TVA study program was a method to maintain surveillance of the vegetation around each operating steam-electric plant. The method sought was one that would be economical and accurate and would provide information that was current. The literature did indicate that foliage sampling of selected species and chemical analysis would reveal sulfur buildup. It soon became apparent that this method would not be satisfactory to maintain surveillance. The number of steam-electric plants involved and the time required to collect and analyze samples did not provide current information. The decision was reached to build a surveillance program around indicator species selected from native vegetation.

The following characteristics were desirable for any species selected as an indicator:

1. It should be sensitive to SO$_2$ at a level below the sensitivity of vegetation of economic or aesthetic importance.
2. It should be widely distributed in the area of interest.
3. The markings by the chemical of interest should be characteristic and easily observed.
4. The species should be present throughout the growing season.
5. The species should grow from the terminal shoot throughout the growing season.

**Selection of Indicators**

The first of the seven major steam-electric plants to go into operation was the Johnsonville plant located on Kentucky Lake in Humphreys County, Tennessee. This plant was put into operation before the stacks were completed to design height. During the early period of operation, the smoke was frequently brought to the ground near the plant during periods of high wind. The area adjacent to the plant thus affected provided an outdoor laboratory. The majority of the study on the effects of SO$_2$ on vegetation was conducted in the area adjacent to the Johnsonville plant.

This area contains a large number of plant species due to the great variety of habitats. To the west of the Johnsonville plant, Kentucky Lake which is approximately two miles wide. The terrain on the west side of the lake consists of rolling hills extending about 280 feet above the lake level. These hills are composed of sand. The hills close to the lake are composed of dry, cherty material and have little top soil. Farther to the west, the hills are covered with upland vegetation.