

Health Conservation Activities of TVA

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THE WIDELY reported accomplishments of the Tennessee Valley Authority in regional resource development have involved many practical applications of the art and science of modern preventive medicine and public health. It was early recognized that the program would necessarily be concerned with health in two different areas: one, the health and safety of its employees; the other, the impact of its major activities on health problems of regional significance. Responsibility for both interests has been centered in a single administrative unit of TVA, the division of health and safety.

An important factor in TVA's success in the health field as well as in other fields has undoubtedly been the flexible management system under which the program operates. Former Chairman David Lilienthal described the essential characteristics of the system as follows: "... a Federal autonomous agency with authority to make its decisions in the region; ... responsibility to deal with resources as a unified whole, clearly fixed in the regional agency, not divided among several centralized Federal agencies; ... a policy fixed by law that the Federal regional agency work cooperatively with and through local and State agencies" (1).

Dr. Derryberry is director of health of the Tennessee Valley Authority. This paper is a revision of the material he presented at a seminar conducted by the University of Pittsburgh School of Public Health in April 1951.

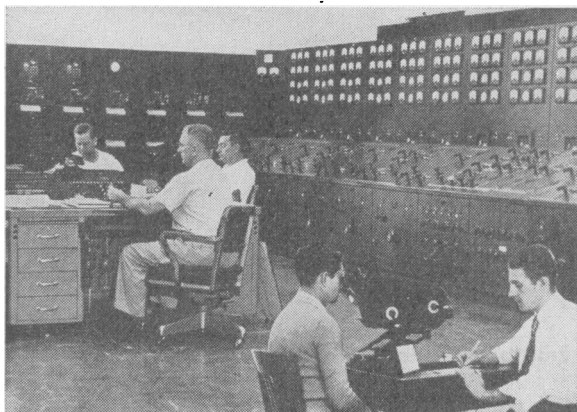
Employee Health and Safety

Appropriate as objectives of a sound program of employee health and safety services are the "three declared purposes of public health" named by Dr. Haven Emerson and Dr. Thomas Francis, Jr., at an informal conference called in March 1951 to consider future directions of public health. These objectives are "to develop and improve health among our people, to protect them against preventable diseases, and to prolong the average length of life in terms of both quality and quantity."

The TVA employee health and safety program includes preplacement medical examinations, immunization service, periodic health examinations, health education and guidance, prevention of accidents, medical and engineering control of occupational health hazards, and mental hygiene services, along with treatment and rehabilitation of the industrially disabled worker. It is viewed as a dynamic management service undertaken to promote efficiency and economy through the conservation of employee health and as a valuable part of good employee-management relationships. Protection of the health and safety of workers is a responsibility of management recognized by the workmen's compensation laws. Management does not, however, always recognize that provision of this service is also an opportunity to protect its investment in the effective manpower so necessary for successful operation in a highly competitive economy.

To the difficulties ordinarily encountered in the administration of a program embracing these functions must be added, in TVA, the

Vision testing of employees in a powerhouse, a measure which promotes efficiency and aids in the conservation of sight.



factors of dispersion of employees over an area covering 80,000 square miles, a great variety of high-risk occupations in which employees must be carefully placed so that their assignments will be within their physical capacity, and the necessity for developing methods by which the services of State and local health agencies and community medical services may be effectively utilized. At locations where large numbers of TVA employees are concentrated, most of the services are provided through field units operated directly by TVA. The services of local and State health agencies are, however, utilized to the greatest extent feasible. Immunizations, chest X-ray surveys, laboratory service, and communicable disease control are examples of services provided from this source.

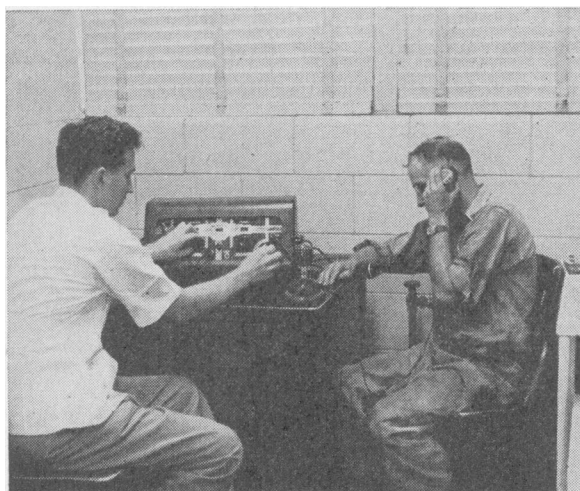
Not the least among the tasks to be accomplished in carrying out an employee health and safety program is the enlistment of the cooperation, support, and participation of the operating divisions of the organization. Where supervisors in the construction division, the chemical engineering plant, or the power plant, for example, participate actively in identifying needs for health and safety service and in developing plans to meet those needs, inevitably a better job is done than could be done by the division of health and safety alone. This approach also permits sharing on a broader basis the satisfaction of having determined the need for action and of having taken it.

Sometimes a problem in learning to share responsibility is also encountered within the organization directly responsible for provision of health services. This problem arises principally from the fact that in matters of health the traditional role of the physician has been authoritarian. It is not always easy for him to realize that in preventive and industrial medicine and in public health the medical sciences are but a part of the total technology which must be applied to achieve maintenance of health and prevention of disease and disability.

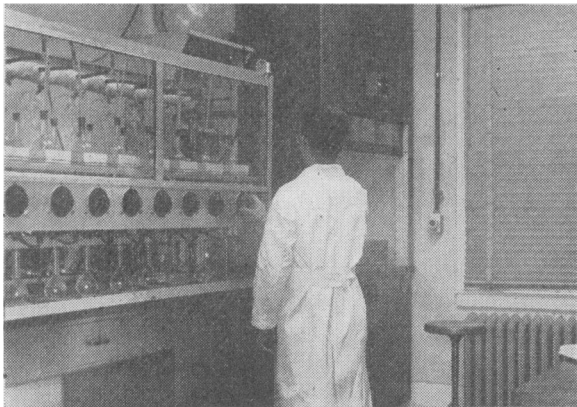
Services Provided

Figures on the number of services TVA has provided show that its interest in employee health has been realistic. Between November 1, 1933, and July 1, 1952, well over half a million medical examinations were performed; more than 400,000 immunizations against communicable diseases were provided; over a million health maintenance services, including professional consultations, were made available; and about a million job-related injuries were treated. In addition, more than 550,000 clinical diagnostic laboratory services were furnished, and over 90,000 dental hygiene services related to specific occupational disease hazards were given. Until venereal disease treatment was simplified by the establishment of rapid treatment centers and by the provision

Testing hearing of an employee to insure his fitness for work that requires good hearing.



Industrial hygiene laboratory, Wilson Dam, Ala. The section shown is devoted to fluorine studies in connection with the operation of the Tennessee Valley Authority chemical plant.



of widespread services through State health departments, over 100,000 venereal disease treatments were administered.

Some appraisal of the qualitative effect of the services can be made by such observations as the number of employees with physical defects who benefited from occupational placement and the number of referrals and corrections made following periodic health examinations. For example, at one Tennessee Valley Authority construction project 15 percent of the 2,344 employees were selectively placed in jobs having requirements compatible with their physical limitations as determined by employment medical examinations. Periodic medical examinations have found as many as 50 percent of the employees examined to have some condition for which corrective advice or treatment was indicated and referral made. Also significant is the fact that not a single case of smallpox or typhoid has been known to occur at a TVA construction camp.

The accident frequency rate was lowered from 62.5 accidents per million man-hours worked in 1935 to 5.5 accidents per million man-hours worked in 1951. Accident severity was reduced from 6.95 days lost per thousand man-hours worked in 1935 to 1.45 days lost per thousand man-hours worked in 1951. During this time the employee population of TVA varied between about 12,000 and 42,000, with an average of about 15,000. It is a matter of simple arithmetic

to calculate the saving in the cost of accidents effected by these reductions.

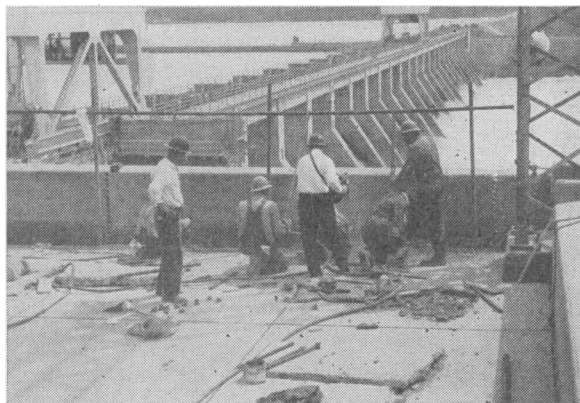
The application of the preventive concept to all phases of the development of projects from planning through construction and operation, the masterful job in safety education done by technicians in collaboration with supervisors, and the close integration of the interests of preventive-minded safety engineers and industrial physicians have all undoubtedly served "to develop and improve health among our people, to protect them against preventable diseases, and to prolong the average length of life in terms of both quality and quantity."

Malaria Control

By direction of the TVA act, water control in the Tennessee Valley is undertaken "primarily for the purposes of promoting navigation and controlling floods" and to produce, transmit, and sell power "so far as may be consistent with such purposes." But the effects of water control inevitably are not limited to navigation, floods, and the generation of electric power. Water control, accomplished in the river channel by the construction of dams and reservoirs and on land through readjustments in agricultural practice and extension of forestry development, has had a significant impact on several regional health problems, one of which is the control of malaria.

In 1933, when TVA was established by Con-

Safety on the job. Employees are wearing "hard hats," goggles, respirators. Dust from extensive drilling operations is controlled as necessary by a "wet drilling" process.



Use of helicopter for larvicidal operations (Kentucky Reservoir)—an example of the newer and cheaper methods employed by TVA in the control of malaria. The helicopter is also used for power transmission line patrol during periods when larvicidal operations are not required.



gress, no one had ever heard of an integrated chain of man-made lakes with a shore line of more than 10,000 miles, which is the Tennessee River today. No one had ever envisioned the problem of malaria control on such a vast expanse of impounded water in an area where malaria is endemic. TVA's experience in the progressive development and application of new methods for the prevention and control of malaria on impounded waters is perhaps its best documented and most widely known accomplishment in the field of preventive medicine and public health.

Before TVA came into being, it had been well established that increased prevalence of malaria followed impoundment of waters in areas of the southeastern United States where malaria was endemic unless effective preventive measures were taken. A house-to-house malaria survey made in 1934 in one of the areas of northern Alabama where a TVA reservoir was under development revealed from 20 to 60 percent positive blood films, with an over-all average of about 30 percent positive. There was no escaping the conclusion that malaria was endemic in the Tennessee Valley and that its prevention and control would be a major problem.

TVA immediately accepted its moral obligation to prevent, insofar as possible, the ad-

verse effects of impoundment of water while at the same time promoting the beneficial effects. Using as a guide such State health department regulations governing the impoundment of water as were then in existence, TVA began its program of planning and developing increasingly more effective and economic methods for preventing and controlling malaria. Planning began on the drafting boards, where the water control structures were designed in such a way as to make naturalistic control measures feasible. Other plans included clearing the reservoirs of timber, providing for marginal drainage by connecting marginal depressions with the main body of the reservoir, and developing operating bases for the application of larvicides in areas which were expected to produce the *Anopheles quadrimaculatus*.

These were the principal control measures known in 1933. Subsequent advances included refinements in methods of reservoir preparation; continuous improvements in methods of applying larvicides; development and application of new larvicides; ecological studies of *A. quadrimaculatus* larvae and adults and the establishment of more effective control of mosquito breeding through planned water level management schedules; and development of a reservoir design to facilitate mosquito control. This reservoir design involves determining areas along the margin that can be remodeled by a combination of deepening and filling and other areas that can be diked and dewatered during the mosquito season.

Through all these steps the TVA team of medical malariologist, sanitary engineer, and biologist had the cooperation and support of the official health agencies. Interest in the control of malaria beyond the zone of influence of TVA reservoirs was quick to spring up. Cooperative efforts resulted in the study of the malaria problem on a county-wide basis in all the counties of northern Alabama. Cooperative effort was also responsible for an extensive program of health education, centered around malaria transmission, in elementary schools, high schools, and teacher-training institutions in the sections of the valley where malaria was most prevalent. Time and time again the staff of the State education department, the State health department, and TVA collaborated in

workshop, community health education programs, and demonstration activities.

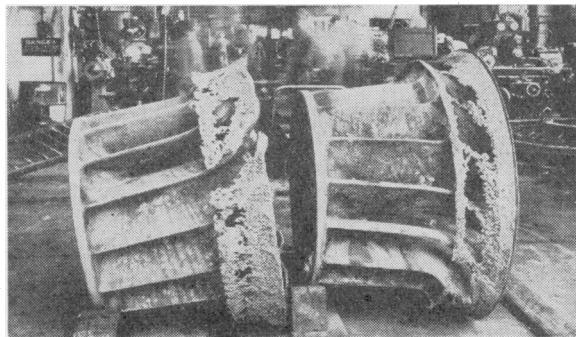
Reservoir by reservoir the magnitude of TVA's control problem increased. Step by step the TVA team made headway in the improvement of old methods, the discovery of new methods, and the reduction of costs. Ideas first studied in the laboratory were taken into the field for trial if there was the faintest hope of success. Methods withstanding the preliminary field tests were put into effect on an area demonstration basis. Those proving successful there were incorporated into the program of malaria prevention and control, where they held their place only as long as they could satisfy the tests of merit and efficiency. In 1949 and 1950 malaria surveys in selected areas around the most likely mosquito-breeding locations in TVA reservoirs failed to reveal a single parasite-positive slide. Careful field investigations in 1951 and 1952 failed to produce a single case of malaria of natural indigenous origin, although they did reveal a few cases of probable Korean origin.

The general decline in malaria prevalence in the southeastern United States during recent years has relieved considerably the pressure under which TVA has had to carry on its malaria control operations, but it has not led to a relaxation of vigilance nor to false complacency. That smoldering coals of malaria prevalence have been known to flare into disastrous epidemic outbreaks is not new to epidemi-

Remodeled reservoir margins showing filling and deepening work to facilitate malaria control (Wheeler Reservoir in northern Alabama).



Corrosion of turbines due to acid waste in Ocoee River. Pollution in this river has since been largely brought under control.



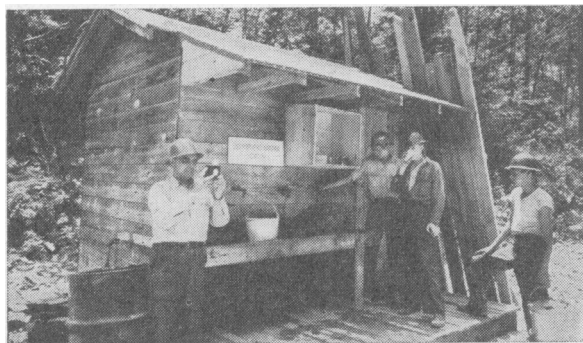
ologists. TVA has no desire to become newsworthy from neglect of its responsibility to prevent malaria transmission as a result of impoundments.

Stream Sanitation

The conversion of a flowing river into a series of impounded reservoirs and the changes in the chemical, physical, and biological characteristics of water following impoundment provide the basis for TVA's interest in stream sanitation, another regional health problem.

Man has long been torn between a struggle of conflicting stream sanitation interests: one seeking to maintain streams in their natural state of purity; the other attempting to use the streams as a convenient sewer for disposing of the end products of man's physiological and industrial processes. Somewhere a balance among the many reasonable and proper uses of water must eventually be found. Balanced use must take into consideration such items as public or industrial water supplies, fish and wildlife propagation and conservation, recreational activities, power development, flood control, erosion control, discharge of industrial wastes and domestic sewage, irrigation, and perhaps others. Development of a stream sanitation program requires identification of either limited or fundamental conflicts among different water uses, a resolution of these conflicts if possible, and the establishment of a fair, reasonable, and coordinated plan which will achieve and maintain a continuing balance among the various interests.

Safe drinking water on the job is a "must" for TVA projects. Here, a sample of water is being tested at one of the construction projects.



Since 1936, TVA has actively engaged in a program to promote the prevention and control of pollution in the Tennessee River system. The objective has been the protection and general development of the value of water as a basic physical resource of the region. At about the time interest began to crystallize into action, TVA was requested by the State health officers in the valley to undertake a fact-finding survey of the Tennessee River in order to define the pollution problem and obtain the data needed in planning for control. Organized, comprehensive information on the condition of the Tennessee River system was not available, and, furthermore, it was recognized that a program of river development would greatly alter the capacity of the stream to handle pollution.

Critical sections of the Tennessee River and its major tributaries were studied, and surveys of typical industrial plants discharging liquid wastes into the river system were made. As sections of the river system were impounded, the effects of impoundment on stream sanitation were placed under study. Analyses of industrial wastes and estimates of their effect on stream pollution in terms of population equivalents were made; the impact of domestic sewage on the pollution problem was evaluated; the biochemical oxygen demand of various wastes was studied and findings correlated with dissolved oxygen conditions and stratification phenomena in reservoirs. The data compiled can be used to draw a picture of water quality conditions in the river system as they now exist as well as some sketches of what they ought to be from the standpoint of balanced stream sani-

tation interests. From these data can be obtained also some outline of how the job of correction can be done and approximately how much it will cost.

Stream sanitation has been an area of very active collaboration between TVA and other Federal agencies—the Corps of Engineers, the Federal Works Agency, the Public Health Service, and the Atomic Energy Commission. In cooperation with the Atomic Energy Commission, ecological studies are being made in a small tributary impoundment which serves as a stilling basin where certain radioactive wastes are discharged. Collaboration with the Public Health Service, as well as with the States, is currently exemplified by the preparation of several reports on conditions in the Tennessee River Basin. These reports can be most useful to the Public Health Service in connection with its responsibilities under the Water Pollution Control Act of 1948 and will be a valuable aid to those whose duty it is to take corrective and preventive action.

The cooperative effort between the TVA staff and the State health departments has helped to awaken general public interest in stream sanitation in the Tennessee Valley, as evidenced by the passage of legislation relating to stream pollution control in recent years in several of the valley States and by increasing corrective action being undertaken by private industries and public agencies. The job of stream sanitation is by no means complete, however, for many troublesome spots remain. Conflicts between water use interests still exist, and many of the elusive facts concerning the effect of water impoundment on stream quality have not yet been corralled.

Other Health Problems

TVA has also been concerned with such health problems as provision of water supply and sewage disposal systems in its temporary construction villages; sanitary supervision of food-handling establishments serving construction workers living in dormitories; investigation and control of communicable diseases; provision of a safe milk supply; and sanitation of temporary housing developments and trailer camps. These needs have been met largely through close collaboration with official health agencies since

TVA is without authority except on property which it owns and controls. Where there was no organized local health unit in existence, TVA has frequently pooled its resources with those of the local area and of the State health department to help establish or strengthen a full-time local health department. As TVA construction wanes, the support of these services is in most instances being assumed by the communities and the States.

Though many of these health problems have been transitory, TVA has remained in the public water supply business on a large scale. It presently operates 30 water treatment plants at TVA dams and reservations. To the greatest extent feasible, TVA relies upon official health agencies to supervise these installations but must itself maintain a degree of surveillance over them in order to discharge its responsibility for protection of employees and the visiting public. Similarly, most of the services to recreational developments along TVA lakes have now been taken over by local health departments.

Another health problem to which TVA is giving attention is that of atmospheric pollution. In developing plans for new steam-operated generating plants to meet the increasingly urgent demands for power in the Tennessee Valley, TVA is giving careful study to

the potential problem which may be associated with the discharge of fly ash, fumes, gases, and other waste materials so that necessary controls may be included to the greatest extent possible in plant design and construction.

Flexibility and Progress

The events and activities described here were not all, of course, the result of a perfect plan completely conceived in the beginning of the Tennessee Valley Authority. It is doubtful that anyone envisioned all the ramifications which have been a part of the program. Without question, a major factor contributing to TVA's success in dealing with a multiplicity of related interests has been the flexible management scheme at the heart of TVA. With authority and responsibility for leadership in the unified development of the resources of the region clearly fixed in a single agency, the many and complex technical and social problems have been boldly engaged. The result has been outstanding progress in the promotion of human welfare in the Tennessee Valley.

REFERENCE

- (1) Lillienthal, David E.: TVA—Democracy on the march. New York, Harper & Brothers, 1944, p. 153.

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