

Chapter 1

THE BARTLESVILLE CENTER: HISTORICAL OVERVIEW

The Bartlesville Energy Technology Center is housed on four square blocks of the west side in Bartlesville, Oklahoma. Surrounded by small homes in a modest residential district, it is not a physically impressive place measured by the standards of the Department of Energy which administers it. The technology center's main building, a solid 1936 red brick structure, might pass for a junior high or high school. Across the street, a new laboratory and office structure has the anonymous modernity of the 1960s. Temporary structures, outbuildings, and office trailers fill the small compound. Yet the BETC has a unique institutional history, including the sparking of a heated local controversy in 1982 which extended to Oklahoma's congressional delegation, the Department of Energy headquarters in Washington, and powerful lobbying groups and institutions in the oil business throughout the nation.

As a federally owned and operated facility, the center is something of an anomaly in the 1980s—a survivor of an earlier era, in which government played an internationally recognized role, which was welcomed and supported by private enterprise, in the advancement of petroleum technology. Even as recently as the 1982 controversy, surprisingly, some strong free-enterprise advocates from the oil industry were arguing that *this* federal facility should *not* be closed down as part of the fulfillment of Ronald Reagan's campaign pledge to dismantle the Department of Energy and reorganize its functions.

The center has always been warmly supported by local and regional oil interests. When, in 1916, the Bureau of Mines announced its intention of establishing a petroleum experiment station somewhere in the United States, oil men in Bartlesville lobbied intensively to have the station built there, in hopes of achieving official recognition of their community as an oil metropolis. Through the Chamber of Commerce, local oil executives pledged \$50,000 to assist the government in construction; and one of the town fathers, George Keeler, promised to donate a plot of land for the station. In 1917, the Bureau accepted both

offers and sent a representative to take possession of the property and to supervise construction. Once established, the small facility survived through drastic changes in national politics and the economic vicissitudes of the local and national oil industry.

The evolution from 1918 to 1982 of the Bureau of Mines' experiment station into the Department of Energy's technology center provides glimpses of crucial issues in the history of technology. How does the process of innovation take place in an institutional setting? What are the important factors influencing the dynamics of laboratory research? Just as the biography of a long-lived individual can illuminate the history of an era, so the 65-year span of the center offers insights into questions of regional and national significance. How did national political philosophy affect the government's role in petroleum research? How could a federal role be established in an essentially private industry? How did the center fit into the oil industry's own internal politics—the divisions between the major multinational corporate giants and the independents, between refiners and producers, between East Coast and Mid-Continent companies?

Although shaped inevitably by such larger forces, the center is also the product of its community. The town of Bartlesville lies in the gently rolling "Green Country" section of northeast Oklahoma, fifty miles north of Tulsa and some twenty miles south of the Kansas border. To a visitor, Bartlesville at first seems a model of mid-America. A downtown section boasts a few high-rise office buildings, punctuated by one- and two-story retail shops. Quiet neighborhoods with neatly trimmed lawns house the thirty-five thousand residents. Truck-mounted campers and boats on trailers stand next to carports in the residential sections; fast-food outlets and discount markets line Highway 75 as it stretches north through the eastern side of town.

On closer examination, the small city is almost too much like Sinclair Lewis' *Mainstreet* to seem a completely typical 1980s community. For one thing, Oklahoma remains "dry," the last state to prohibit the

sale of liquor by the drink. For another, eighty churches, twenty of them Baptist, dot the neighborhoods, attesting to the survival of an earlier generation's values. Crime is rare, and the local radio station treats occasional reports of juvenile vandalism, domestic strife, or auto collision as news.

This air of preserved stability is enhanced by evidence that Bartlesville is a company town—headquarters of Phillips Petroleum—which far overshadows the presence of the small federal facility. The familiar “66” signs over gas stations outnumber emblems of competing brands. Frank Phillips Boulevard leads from Highway 75 into the town center, past the Jane Phillips Memorial Hospital, past the company's corporate headquarters downtown, west to the Phillips Company's own research center, which is a set of massive structures on the city limits. A few miles to the south lies Woolaroc—once the private estate of Frank Phillips, now a tourist attraction with a museum housing Phillips' personal collection of Western art and Indian artifacts and a small herd of American buffalo.

The community reflects its petroleum heritage also in other ways and remembers when, in the early decades of this century, it was the center of the first oil boom in Oklahoma. Outside the town, dotted through pastures and fields, oil pumps slowly drain the once-rich stratum called the Bartlesville Sand. And in the middle of Bartlesville, on the banks of the Caney River, stands a restored wooden derrick, a monument to “Nellie Johnstone Number One,” reputedly the first commercial oil well in Oklahoma.

The technology center, like the town, has always carried an imprint of the era of its birth. The Bureau of Mines, first established in 1910 within the Department of the Interior, had been created out of the political philosophy of the Progressive era. Progressives in the Bureau of Mines held that the natural resources of the nation should be managed in the national interest and argued against the followers of John Muir who sought to preserve nature from man's exploitation. For the Bureau in 1910, management of natural resources did not imply eternal preservation; but it did mean the wise development and use of those resources. Natural resources, even when privately owned, should be exploited in a way that stretched their use over the longest possible period. Although viewed as conservation, such a rationale differed markedly from the environmental preservation style of conservation advocated by Muir and taken up as a popular cause by later generations. Progressives warned against pollution, arguing that pollution from the unwise exploitation of one valuable resource could damage or destroy another. But the avoidance of pollution, like the avoidance of waste, served the purpose of wise exploitation, not static preservation.

The Bureau of Mines, in the spirit of the Progressives' search for social justice, also reflected a concern for the industrial safety of workers and sought to advocate and promote safety measures. Businessmen who prided themselves on enlightened development of resources could regard such efforts by government as supportive. Dissemination of information about new methods to eliminate waste and enhance worker safety did not contradict the businessman's pursuit of profit; on the contrary, such information could help earn even greater profits. Good information meant good business. To further this objective, the Bureau of Mines established experiment stations which, like the Agriculture Department's demonstration stations, would bring technical experts to the field. The Bureau's stations specialized each in a different extractive industry—stations for coal, quarries, clay pits, and iron mines were all established in different appropriate locations, close to the major centers of each resource.

The decision by the Bureau of Mines on the location of a station for the oil industry represented an official definition of the oil industry's center—making it imperative that the choice be made with care. Rockefeller had based the Standard Oil Trust on Pennsylvania and Ohio oil, and had built refineries in New Jersey and New York. By 1916, however, the center of oil activity and production had shifted westward. The wide popularity of the automobile had created a demand for petroleum which was met at least in part by new discoveries in Texas and Oklahoma. In addition, in 1911 the government's anti-trust suit had broken the Standard Oil Corporation into thirty-five companies. But even before the suit, fiercely independent producers of the Mid-Continent region were already proud of their new competitive system of oil production, as opposed to the monopolistic situation represented by Standard Oil. The already independent producers in Oklahoma, therefore, viewed the selection of their own territory for the Bureau's oil station as an affirmation of the industry's new center.

The selection of Bartlesville, Oklahoma, thus reflected the internal politics of the oil industry in 1916. The rationale and allegiances developed at that time have remained its legacy.

Over the years since 1918, the small center has produced a steady stream of innovative articles and reports, inventions, patents, demonstration projects, and research studies. Since the 1920s, the work of the station has achieved recognition in a range of technical disciplines related to petroleum—including the mechanics of raising crude oil and natural gas to the surface and transporting those fluids; the chemical techniques of rendering crude resources into finished products; and diverse work in engine design, pipeline engineering, emission studies, basic petroleum chemistry, alternative fuels, synthetics, and surveys of particu-

lar petroleum fields, pools, and resources. As petroleum technology evolved during the twentieth century from a relatively primitive, "hands on" approach to a more systematic and scientific one, the Bartlesville center was often in the forefront of development. In carrying out its essential mission of conservation and efficiency, it became a propagandist for new ideas and approaches as it worked *with* private interests to create a sophisticated technological base for the entire petroleum industry. In the decades from the 1920s through the 1960s, oil industry journals reflected a tone of respect and sometimes direct admiration for the technical excellence of the work of the Bureau of Mines' engineers at Bartlesville and at its sister institution at Laramie.* And that respect has been earned by the steady production of direct research from the two centers.

The history of the Bartlesville center provides a good case study to illustrate the progress of technology. Technological research decisions made throughout Bartlesville's history—questions of where to put money, where to assign staff, what device to invent, what process to improve—were by no means self-propelled innovations that proceeded outside human control. As in most human affairs, the advance of technology cannot be readily explained according to a pre-set formula, in spite of widespread fears to the contrary. Rather, individual men make those decisions, because of a host of usually very mundane factors. Particular staff members might find themselves with time and the need of a "problem;" the oil industry might be interested in a particular new development for financial reasons; Washington might support a local decision if it appeared politically sound and if budget constraints could be met. All these occurred in BETC's case. In addition, the demands of war and emergency suddenly altered priorities, redirecting progress to stimulate new lines of work or to retard developments that were already underway. Outside institutions, agencies, and corporations often sought particular work, to which the center responded in varying ways (according to staff, equipment, and policy dictates). Each particular research and development decision reflected a specific mix of factors at work at a particular time and place.

In 1918, as the Bureau established the station, the mix of factors at work on the petroleum industry included a greatly increased demand for gasoline. Most of the innovation stimulated by this increase came, as noted, not from laboratory settings but from trial and error by practical men in the field. Few trained geolo-

gists had yet joined oil firms, and the search for drilling sites was mostly a hit-or-miss, intuitive process. Gradually, university-trained researchers began to make contributions. A handful of engineering graduates from Stanford University began to concentrate on methods of improving drilling equipment; the University of Pennsylvania initiated a program in petroleum chemistry. Yet the number of technically trained geologists, engineers, and chemists in the oil industry remained limited.

In the search for methods to drill to deeper depths, the rotary drill bit, invented by Howard Hughes, began to supplement the traditional method of drilling with a chisel-like tool attached to a cable or rope. Refinery processes innovated by William Burton, a Ph.D. chemist at Standard of Indiana, held out the promise of alleviating the gasoline demand. Standard Oil Development Company, founded in 1922 as a research arm of Jersey Standard, set out to find a refinery process to compete with Standard of Indiana's Burton method. Both Texaco and Gulf set up similar research efforts later in the 1920s. Cities Service, successor to Empire Fuel and Gas in Bartlesville, established a research laboratory there under the leadership of Henry Doherty.

Yet the bulk of oil continued to be drilled and recovered by relatively small, often individually owned firms who marketed their oil to the refining companies. In the hasty, boom-and-bust world of oil drilling, independent drillers simply could not consider sponsorship of research. As the Bureau expanded the Bartlesville experiment station, it became one of the first settings for the systematic application of engineering and scientific methods to the oil business.

Responsiveness to outside pressures did not prevent the center from having its own internal institutional life. Staff currently at the center have worked with colleagues who came to it in the 1930s; they, in turn, some of whom live in retirement in Bartlesville, remember working with the first generation of staff from the 1920s. Continuity in ways of doing things, in relationships with industry, in personal compatibility, and in likes and dislikes have created a distinctive institutional personality. Growing slowly from a staff of three, to forty in its first decade, and eventually to two hundred by the late 1970s, the institution's personality reflected the continuity of influence of old-timers on newcomers. For the most part, the institution's personality did not change suddenly. Even when a new division was added, the effect of such growth spread over months and years. Dismissals, resignations, and the hiring of individuals altered the patterns slightly, but the institution and its ways of cooperating with industry continued. Although its name changed—from Experiment Station to Petroleum Research Center, to

*In 1922, the Bureau of Mines established another petroleum field station at Laramie, Wyoming. As oil fields came in throughout the Wyoming area, the Laramie station served the producers of that region. The two stations at Laramie and Bartlesville kept in close touch, sometimes exchanging personnel, and survived together, through various bureaucratic reorganizations, as sister institutions.

Energy Research Center, to Energy Technology Center—its institutional continuity remained.*

Each Superintendent or Director worked to provide leadership and direction, but sometimes the institution's own inertia seemed to limit the impact of particular individuals. After an initial period of rapid turnover of Superintendents, N. A. C. Smith directed the center from 1926 to 1946. Smith, a specialist in refining chemistry, sought—with gradual success—to convert the station from a field demonstration center into a research laboratory with its own scholarly publication and achievement record. By the end of World War II, the station had established a national reputation in oil field engineering studies, thermodynamics of petroleum compounds, and characterization of fuels and products, as well as in production methods. From 1947 to 1963, Harry Fowler, a safety engineer, served as Superintendent and provided considerable autonomy to internal division leaders whose groups sought outside funding to pursue research. In this period, the center's reputation among oil men for research and innovation continued to grow, with projects frequently linked through cooperative agreements to the activities of national industrial associations and other government agencies.

From 1963 through 1978, director John Ball, a research chemist with a long record of Bureau of Mines work at the sister facility in Laramie, led the center to a new style of work—building teams which supervised government-funded research contracts performed by outside contracting firms and institutions. From 1979 to 1982, Harry Johnson, a petroleum engineer, sought to preserve and expand the center's role as a lead center for all liquid fossil fuel research and for enhanced oil recovery work, and to protect the center's internal and contracted research from the political and budgetary storms that struck Washington during his tenure.

Under the leadership of these four men, the center retained much of its initial character, providing research services to oil producers, disseminating information on technology, and providing analyses of crude oils. By the 1950s, under Fowler, its field of service had expanded from the Mid-Continent to the whole nation and had begun to reach overseas. By the administrations of Ball and Johnson, the center was engaging widely in international activities. Through the period of expansion of role and acceptance of new responsibilities, the center continued to maintain its unique relationship with industry—a service center which cooperated actively with private firms, yet avoided any interference in the competitive marketplace, either as a regulator or as a patron of particular

firms. That principle of cooperation without favor accounts at least partially for the continuing good relations between the center and the private oil industry.

The very acceptance by industry of the significance of the center's work served as a stimulus to innovation—not only in the abstract sense of moral support but in dozens of practical ways. Staff from the center sometimes resigned to take positions in industry, often remaining in contact with their former colleagues. Private companies frequently provided facilities, samples of crude oil or products, personnel on loan, and data, knowing that proprietary information would remain protected. Industrial conferences provided settings for the delivery of technical papers authored by center staff. Commercial and scholarly journals, subscribed to and supported by the private sector, served as other outlets for research. Industrial associations such as the American Gas Association entered into cooperative agreements with the Bureau of Mines, offering funding to assist the government in particular research projects along specific lines agreed to be of interest to the member companies of the association. The rich variety of liaisons between industry and government through the center, initiated under the Progressive good-knowledge-makes-good-business philosophy of the Bureau of Mines, continued through the changing political environments of successive decades. The continuity of liaison, the tradition of cooperation, and the apparently fixed heritage of a place in the heart of the oil country and the oil industry, rather than stifling innovation, provided an environment that fostered it.

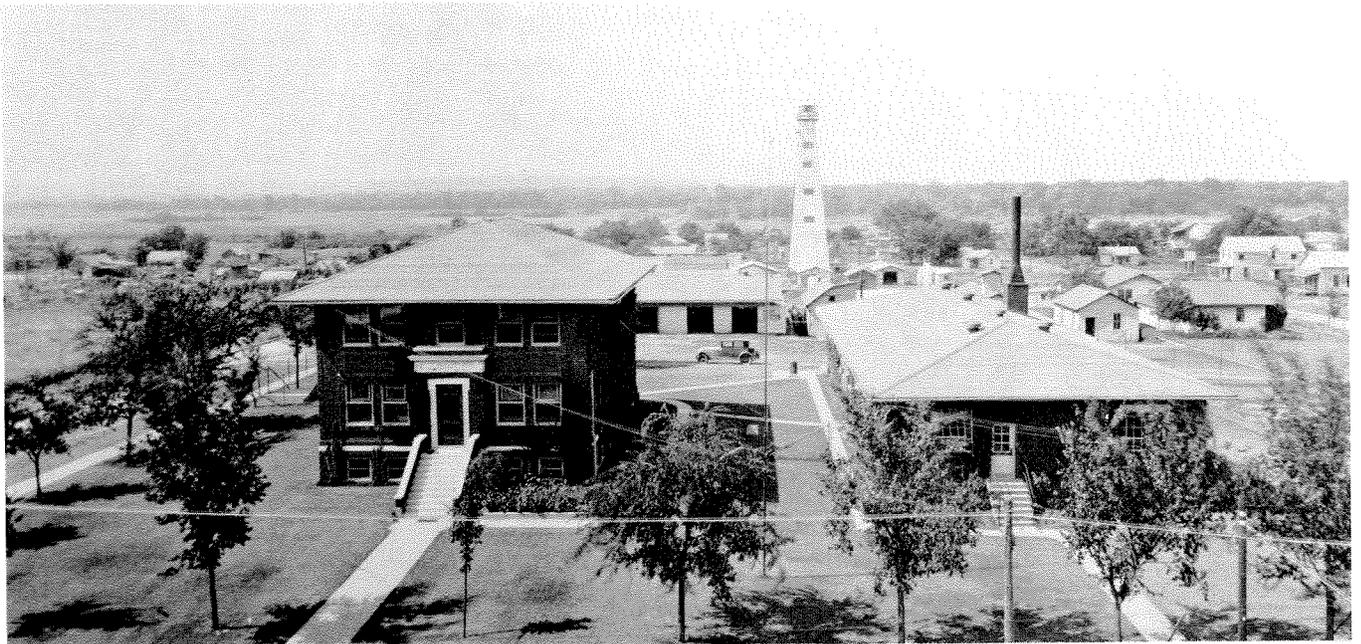
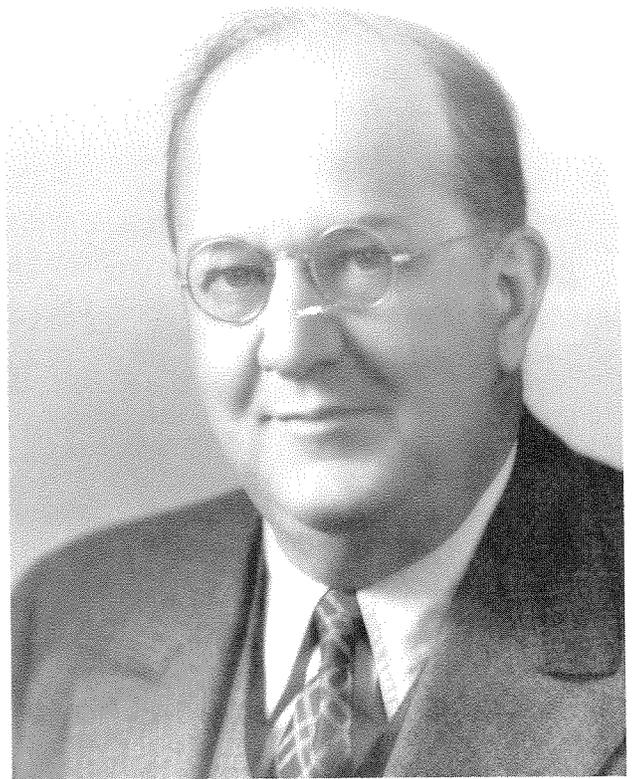
The story of innovation in response to industry needs and interests did not always place the center at the frontier of progress. Limitations of budget and constraints of personnel and background sometimes resulted in a perpetuation of projects and studies past the time of their immediate application. Like all research, much of the petroleum work of the station necessarily involved the pursuit of blind alleys, repetition of numerous unsuccessful alternate solutions, and simple, hard, all-night drudgery with no positive results. The story of the center, therefore, is necessarily a story of setbacks, disappointments, and periods of low morale and stagnation as well as technical progress and advance.

No one has yet written a history of the Bureau of Mines, nor of the Energy Research and Development Administration (ERDA)—the agency which, from 1975 to 1977, combined the energy research and development efforts of the Atomic Energy Commission with energy research facilities from the Bureau of Mines—nor of the Department of Energy, which followed ERDA and took over its mandate. This book's close focus on the story of the Bartlesville Energy Technology Center cannot substitute for such agency

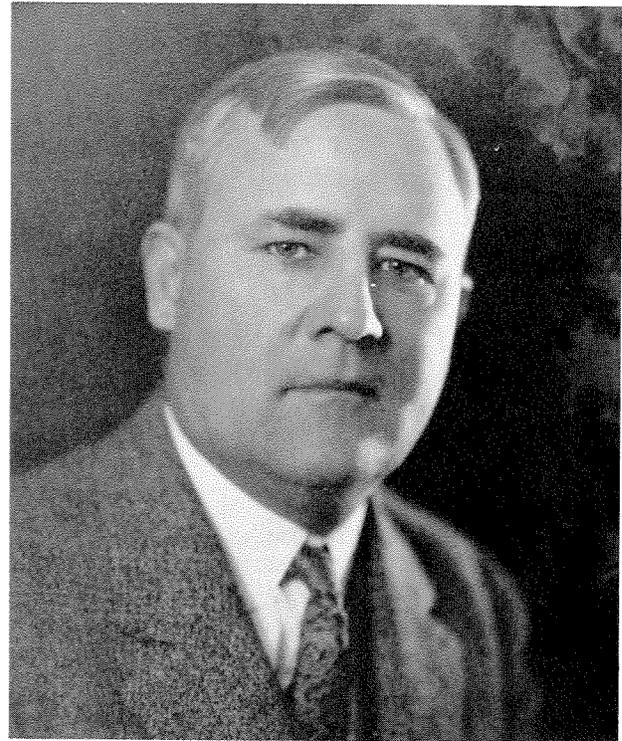
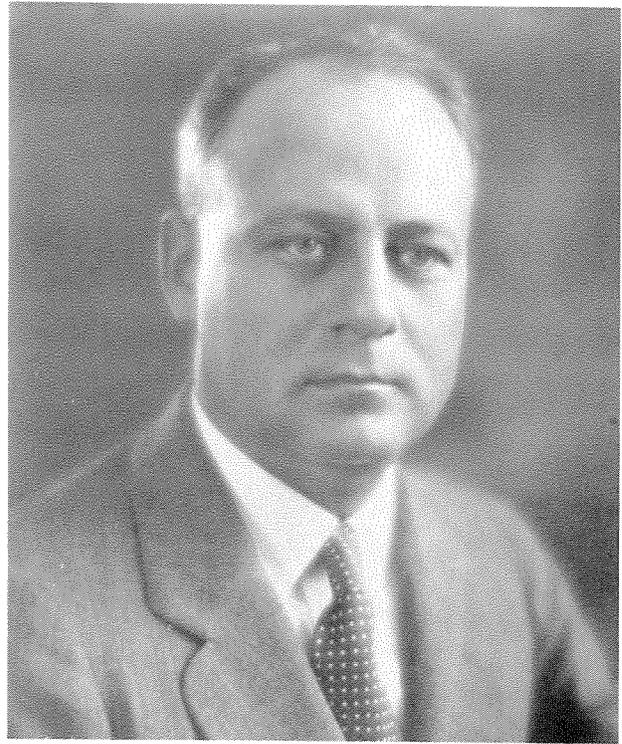
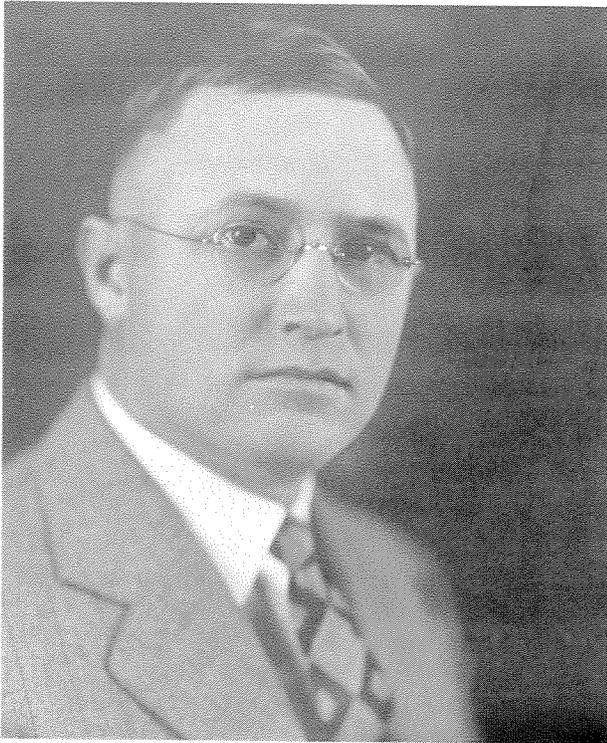
*In the chapters that follow, the Bartlesville institution will be referred to as "the station" or "the center" according to its name during the period being discussed.

or departmental histories, which could trace the interaction of government policy and practice on a grand scale. But the study of a single facility may illuminate particular problems and thus contribute

importantly to our knowledge of how petroleum technology, petroleum policy, and national political priorities have interacted through seven decades of the twentieth century.



J. O. Lewis (upper left) was first Superintendent of the Bureau of Mines Petroleum Experiment Station, serving from 1918–1919. He later founded an international petroleum consulting firm. N.A.C. Smith (upper right), Superintendent, (later Supervising Engineer) from 1926–1945, was the first long-time Director and led the station to a new role as a research laboratory. The Station in 1928 (lower) consisted of the first two buildings constructed in 1918 plus various auxiliary buildings and an experimental oil well.



Training Ground for Industry

Many of the early superintendents of the Petroleum Experiment Station served only short times as they left to take their expertise to industry. A. W. Ambrose (upper left) served in 1920 before going to Washington as Chief Petroleum Technologist of the Bureau of Mines. He was later with Cities Service Oil Company, rising to Chairman of the Board. H. H. Hill who served in 1921-1922 (upper right) also served in Washington and then went with Standard Oil Company of New Jersey. T. E. Swigart (lower left) served in 1922-1924 before leaving to join Shell Oil Company where he later became President of Shell Pipe Line Company. M. J. Kirwan (lower right) was superintendent in 1924-1925 and left to join the Indian Territory Illuminating Oil Company, later merged into Cities Service Company.