

WAR EMERGENCY PIPELINE
(Inch Lines)
INCH LINES HISTORIC DISTRICT
Pittman Road
Longview vicinity
Gregg County
Texas

HAER No. TX-76

(The Inch Lines begin at Station No. 1 on Pittman Road, Longview, Texas, and run approximately 1,340 miles northeast through Texas, Arkansas, Missouri, Illinois, Indiana, Ohio, West Virginia, and Pennsylvania and terminate at Station No. 27 on Stiles Road, Linden, New Jersey.)

PHOTOGRAPHS

WRITTEN HISTORICAL AND DESCRIPTIVE DATA

HISTORIC AMERICAN ENGINEERING RECORD
Southwest System Support Office
National Park Service
P.O. Box 728
Santa Fe, New Mexico 87504

HISTORIC AMERICAN ENGINEERING RECORD

WAR EMERGENCY PIPELINE
(Inch Lines)
INCH LINES HISTORIC DISTRICT HAER No. TX-76

LOCATION: Texas Eastern Transmission Corporation Longview Station No. 1
Pittman Road, Longview vicinity, Gregg County, Texas

USGS Lakeport, TX, Quadrangle;
UTM Coordinates: 15.339020.3592030

(The Inch Lines begin at Station No. 1 on Pittman Road, Longview, Texas, and run approximately 1,340 miles northeast through Texas, Arkansas, Missouri, Illinois, Indiana, Ohio, West Virginia, and Pennsylvania and terminate at Station No. 27 on Stiles Road, Linden, New Jersey.)

DATE OF CONSTRUCTION: 1942-1943

ENGINEERS: Charles P. Cathers, Defense Plants Corporation; Oscar Wolfe, War Emergency Pipelines, Inc.

CONTRACTORS: War Emergency Pipelines, Inc. (WEP)

BUILDER: United States Government

PRESENT OWNER: Texas Eastern Transmission Corporation (TETCO), Houston, Texas

ORIGINAL USE: Crude oil pipeline

PRESENT USE: Natural gas pipeline

SIGNIFICANCE: Construction of the Big Inch and Little Big Inch pipelines (Inch Lines) signaled a revolution in fuel transportation. Before the construction of this 24-inch-diameter line, most oil pipelines were no more than eight inches in diameter. Stretching 1,340 miles from Texas to New Jersey, the Big Inch was the largest, heaviest, and longest pipeline built up to that time. During its operation from August 1943 until August 1945, it delivered 300,000 gallons of oil a day and provided a secure transportation system beyond enemy reach, thereby becoming a "symbol of American spirit." The wartime success of the Big Inch and Little Big Inch ushered in the expansion of pipeline usage that continues to the present day.

PROJECT INFORMATION: The Inch Lines were recorded under the provisions of a Programmatic Agreement among the Federal Energy Regulatory Commission (FERC), the Advisory Council on Historic Preservation, and the State Historic Preservation Offices of Texas, Arkansas, Missouri, Illinois, Indiana,

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Ohio, West Virginia, Pennsylvania, and New Jersey for the Big Inch and Little Big Inch pipelines. The documentation was prepared for Texas Eastern Transmission Corporation (TETCO) by the Cultural Resource Group of Louis Berger & Associates, Inc. (Berger). The written documentation was prepared by Richard M. Casella, Berger Senior Architectural Historian, and Ingrid Wuebber, Berger Senior Research Historian. Berger Senior Photographer Rob Tucher served as Project Photographer.

DESCRIPTION

The Big Inch and Little Big Inch pipelines (Inch Lines) were constructed during 1942 and 1943 for the United States government by War Emergency Pipelines, Inc. (WEP), for the purpose of transporting crude oil and refined petroleum products from the Gulf Coast region to refining and distribution areas near New York City and Philadelphia. The Inch Lines served as an alternative to transport by tankers, which had experienced major disruption as a result of attacks by German submarines. The Inch Lines also supplied large volumes of export petroleum directly to the East Coast so that the limited number of surviving tankers could make a shorter transatlantic trip and meet the demands of the European war fronts.

At the end of the war, the Big Inch and Little Big Inch pipelines became part of the "war surplus property" that the United States government proposed to dispose of to private industry. Formal bids for these pipelines were submitted in early 1947, and the winning bid was that of the Texas Eastern Transmission Corporation (TETCO). Pursuant to the terms of the sale and a subsequent agreement, TETCO converted both of these underground oil/products pipelines to transmission of natural gas, beginning in 1947 and continuing into the early 1950s. In 1957, the Little Big Inch Line was converted back into a common-carrier products pipeline operated by a different company, the Texas Eastern Petroleum Products Corporation (TEPPCO).

The Inch Lines Historic District is a linear, multi-state resource, consisting of 27 individual property parcels, interconnected by a continuous legal right-of-way, located in the states of Texas, Arkansas, Missouri, Illinois, Indiana, Ohio, West Virginia, Pennsylvania, and New Jersey. On 20 of the 27 parcels and along portions of the right-of-way are 62 buildings and structures, physical and engineering components of the Big Inch and Little Big Inch pipelines constructed by WEP during 1942 and 1943. The 27 parcels originally served as locations for petroleum products pumping stations that moved the products through two steel pipelines buried along the right-of-way, which varies in width between 50 and 75 feet. Storage tank farms were located at five of the stations. The name and location of each station and a detailed description of the pipelines follow in the historical background narrative.

The pumping station parcels without storage tank farms originally ranged in size from 11 acres to 44 acres; the parcels that were originally equipped with storage tank farms ranged from 90 to 132 acres. The optimum size of the pumping-only stations was between 15 and 20 acres; 18 of the 22 stations in this category are of that size today and retain their original property boundary lines. The pumping stations with storage tank farms have been reduced in size, following the sale of the tank farms when the system was converted to gas. Each station parcel is enclosed with steel-wire fencing.

Historic resources within the district include the 62 buildings and structures built by the WEP, 45 of which are considered contributing elements of the historic district and 17 of which are considered noncontributing elements. Resources include metal- and wood-frame pump houses, employee cottages, and a variety of small support structures, including sample houses, equipment shelters, firehouses, garages, well houses, office buildings, valves, fittings, piping, motors, and electrical substations.

Overall, the aboveground facilities associated with the Inch Lines today reflect the transformation of the pipelines to natural gas transmission that was initiated by TETCO in 1947 and continued well into the 1950s,

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plus the process, ongoing since that time, of replacing and modifying facilities for business reasons and to ensure the safety and integrity of the pipelines. Of the 27 stations, seven are essentially devoid of resources associated with the construction and operation of the Inch Lines during World War II. Two of these stations (Nos. 14 and 15, in Indiana) were destroyed by fire in 1948 and 1950, respectively, and were therefore completely rebuilt. At four other stations (Nos. 12, 16, 17, and 18), conversion to natural gas resulted in the total replacement of the WEP elements. No structures exist at all at Station No. 24, where concrete slabs are all that remain.

The stations retaining the highest level of overall integrity, with respect to design, workmanship, and materials, are located in Pennsylvania. These four stations (Nos. 21, 22, 23, and 25) were essentially abandoned by 1960, their functions taken over by new stations (Nos. 21A, 22A, 23A, 24A, and 25A) constructed in association with the completion of the 30-inch-diameter Kosciusko Pipeline in 1952, which terminated at Station No. 21A. Although largely stripped of machinery and equipment, these four stations provide the best overall characterization of Inch Line stations as they existed during World War II. The station in Linden, New Jersey (Station No. 27), also retains a number of original features, including three features (firehouse, office/garage/lab, and pump house) of a design unique to the Inch Lines, attributable to this station's position as a terminal facility.

Of the 62 buildings, structures, and other features that today constitute the aboveground remains of the World War II-era Inch Lines, the crude oil and products pump houses remain in the greatest number. Ten of the 17 extant crude oil pump houses, as well as six of the eight extant products pump houses, retain sufficient architectural integrity with respect to original design, workmanship, and materials to contribute to the Inch Lines' significance. The next most common surviving resources are garages (five contributing, three noncontributing), well houses (all five contributing), and crude oil sample houses (all four contributing). Also remaining are at least one example of each of the following station elements: firehouse, products sample house, sump shed, slop tank, office, storage tank (not owned by TETCO), and employee housing (one owned by TETCO and four not owned by TETCO). In addition, several electric motors displaying Defense Plants Corporation (DPC) plates and the remains of motor controls were also recorded. World War II-era station elements of which no representative examples survive include substations, scraper boxes, power/boiler houses, hay filters, separators, and burn areas.

TETCO owns the entire length of the 24-inch-diameter Big Inch Line, and also that portion of the 20-inch-diameter products pipeline east of Lebanon, Ohio (Station No. 16). (The southern portion of this line is owned and operated by TEPPCO, an independent company.) Between Longview and Somerset (Station Nos. 1-18), very little of the original WEP-built 24-inch-diameter pipeline has been changed out (replaced), generally substantially less than 10 percent of each segment between these stations. The same is true for TETCO's 20-inch-diameter line from Lebanon to Somerset. East of Somerset, however, considerably greater percentages of the original pipeline have been replaced since 1945, including up to 100 percent of segments of the 20-inch-diameter line, and one segment of the 24-inch-diameter line, in Pennsylvania. This substantial increase in changeouts is in large part directly attributable to the absence, in the original wartime construction, of protective coating on both pipelines (except at "hot spots" such as river crossings) from Somerset to about 30 miles west of the Susquehanna River, and the concomitant susceptibility of the uncoated pipelines to corrosion if the pipe was not properly maintained or replaced when appropriate.

The Inch Lines buildings lack any stylized architectural details, which is typical of utilitarian and temporary, or in this case “emergency,” buildings constructed with federal money on bases and installations during World War II. With the exception of the housing (cottages) and the offices, the primary function of the Inch Lines buildings was to shelter machinery in the most efficient way. Efficient industrial building design during World War II translated into inexpensive and readily available materials, simply and quickly constructed. The sheet metal buildings constructed during the first phase of the project are of the prefabricated type as manufactured by the Butler Co. and others. As steel supplies tightened during the war, prefabricated metal buildings became unavailable and the construction of the buildings’ frames switched to wood. Some of the first wood buildings erected had wood siding and asphalt shingle roofing, but these materials also became short in supply, giving way to asbestos-and-cement-based shingles and sheeting for roofing and siding. In the case of the cottages and the offices, a very slight amount of liberty may have been given to the designer, such as choice of the type and style of doors and windows, but other than that, the cottages and offices followed federal design guidelines and were devoid of stylized details.

Attributing an architectural style to the Inch Lines buildings is a somewhat futile exercise. Because the buildings were constructed during World War II in a “form-follows-function” style lacking architectural decoration, they lend themselves to being classified as Modern in style. As such, they are part of the Modern building movement of fast, cheap, mass-produced construction established during the war. The Modern style exploded in popularity in the postwar economic boom years and continues in use today. Realistically, only the brick flat-roof buildings with metal casement windows at Station No. 27 in Linden, New Jersey, possess sufficient characteristics to be readily recognizable as Modern in style. The remaining majority of prefabricated metal buildings, and the wood-and-asbestos copies that followed, can be better called Twentieth-Century Industrial.

Detailed descriptions of each type of the surviving Inch Lines buildings and structures are contained in the individual-resource narratives of this report.

HISTORICAL BACKGROUND

The Wartime Context

In the decades preceding World War II, oceangoing tankers carried 95 percent of the crude oil and petroleum products transported from Gulf Coast producers and refiners to the Northeast — some 1.5 million barrels per day. Pipelines, on the other hand, transported only about 50,000 barrels per day. Beginning in 1941, tankers were diverted from the Gulf-to-Atlantic route, going first to Great Britain and later to the South Pacific. Fairly extensive pipeline systems distributed the petroleum within the Northeast and Midwest. During the war, the oil industry and the government undertook 35 different major pipeline projects, making it the greatest pipeline construction period in the history of the industry. By April 1945, pipeline shipments would soar to 754,000 barrels per day (Castaneda and Pratt 1993:16-17; Frey and Ide 1946:101).

Recognizing the vulnerability of America’s tanker transportation system to submarine attacks, Secretary of the Interior Harold Ickes wrote President Franklin D. Roosevelt on July 20, 1940, that “the building of a crude oil pipeline from Texas to the East might not be economically sound; but that in the event of an

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emergency it might be absolutely necessary" (Castaneda and Pratt 1993:17). These sentiments were reiterated by Ickes before a Congressional committee on October 1, 1941 (War Emergency Pipelines, Inc. [WEP] 1943:4).

On May 28, 1941, President Roosevelt appointed Harold Ickes to the newly created position of Petroleum Coordinator for National Defense. Ickes performed his duties as the nation's "oil czar" while continuing to administer the Department of the Interior. Ickes's organization developed into the Petroleum Administration for War (PAW), formally designated in December 1942. The new agency was responsible for meeting the petroleum and natural gas requirements of military and civilian customers. Its responsibilities included reviewing all pipeline construction plans and directing the physical operation of all pipelines. It was a cooperative effort between government and business to manage the flow of oil and gas for the war effort. The PAW also acted as liaison between the petroleum industry and other government agencies. As administrator, Harold Ickes was directly responsible to the president. To ensure industry support, Ickes chose Ralph K. Davies, a Standard Oil of California executive, to serve as the PAW's deputy administrator (Castaneda and Pratt 1993:18; Faces et al. n.d.:n.p.; Frey and Ide 1946:3).

Two of the most ambitious pipeline construction projects in this prewar period involved products pipelines in the Southeast. One was to run from the Gulf Coast of Florida to Tennessee, and the other from Baton Rouge, Louisiana, to Greensboro, North Carolina. Completion of both projects was held up by opposition from the railroads. The Cole bill, signed by President Roosevelt on July 30, 1941, allowed the president to designate any proposed pipeline as necessary to the national defense, and to confer upon the builders the right of eminent domain. The PAW promptly recommended that the law be invoked to complete several pipeline projects, including the various pipelines in the Southeast where construction began immediately (Frey and Ide 1946:102).

On May 15, 1941, a few weeks before the office of the Petroleum Coordinator for National Defense was even established, oil industry representatives had met to discuss the possibility of a crude oil and/or products pipeline from Texas to the East Coast. Ickes and the oil industry agreed that a new transcontinental pipeline was necessary to relieve shortages on the Atlantic seaboard. An aerial survey of the proposed route was immediately begun. The survey, along with a preliminary design and specifications, was completed on September 1, 1941 (WEP 1943:5-6).

A few days later, on September 5, 1941, National Defense Pipelines, Inc., was organized by a consortium of 11 major oil companies to build and privately finance the 24-inch-diameter pipeline. By agreement of the consortium, National Defense Pipelines, Inc., would continue to exist only if some progress on the pipeline project was demonstrated by December 5. The major stumbling block was the allocation of scarce steel supplies by the Supply Priorities and Allocation Board (SPAB). The SPAB had rejected two earlier applications for steel to build the 24-inch-diameter pipeline. The creation of National Defense Pipelines, Inc., failed to persuade the SPAB to allocate the steel. The consortium's agreement expired on December 5; two days later the Japanese bombed Pearl Harbor and the United States entered the war. To meet the war crisis, the oil industry established an advisory council to the PAW called the Petroleum Industry Council for National Defense (later changed to the Petroleum Industry War Council [PIWC]). It first met on December 8, 1941, and was chaired by W. Alton Jones (Castaneda and Pratt 1993:18-20, 22; WEP 1943:6).

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In February 1942, the first 12 American tankers were sunk off the Atlantic coast by German submarines. In March even greater numbers of tankers were destroyed by torpedoes. As the fuel supply on the East Coast dwindled, a revolution in the transportation and distribution of petroleum began. All existing pipelines, railroad tank cars, and barges were dedicated to transporting oil north and east. Private oil companies began unprecedented practices, such as the pooling, exchanging, or sharing of facilities and equipment. However, tank cars and barges could not replace the capacity of the tankers. Oil field and refinery production declined as a result of the diminished amount of oil that could be transported (Frey and Ide 1946:3-4).

Representatives of America's pipeline industry met in Tulsa, Oklahoma, in March 1942 to formulate the basic American wartime pipeline strategy. The resulting "Tulsa Plan," which became the backbone of the PAW pipeline program, focused on developing the nation's petroleum transportation system and reconditioning existing pipelines. One of the plan's components called for the construction of a 24-inch-diameter, 300,000-barrel-per-day oil pipeline from East Texas to Illinois, where part of the supply would be refined and the remainder sent via a 20-inch-diameter pipeline to New York and Philadelphia. The plan also called for a products pipeline to be constructed from East Texas to Illinois. Another project involved converting the pipelines of 12 different companies to an integrated system that would increase the capacity of oil flowing into Illinois and East Coast refineries. Every existing pipeline was analyzed to determine the most effective means of transporting petroleum from the oil fields to the refineries. Miles of pipe were dug up, reconditioned, and relaid in new systems. Old pumps, valves, and meters were salvaged. Begun in the summer of 1942, this integrated system was largely completed by the end of that year (Castaneda and Pratt 1993:20-21; Frey and Ide 1946:103).

Finally, on June 10, 1942, the War Production Board (WPB), successor to the SPAB, allocated enough steel to build the first section of the proposed 24-inch-diameter pipeline from East Texas to Norris City, Illinois. The chairman of the Reconstruction Finance Corporation (RFC) agreed to finance the \$35 million construction project if the oil industry would organize and staff a nonprofit corporation to supervise its construction and operate the completed pipeline. The construction funds would be channeled through the Defense Plants Corporation (DPC), a subsidiary of the RFC, which would own the pipeline, while another RFC subsidiary, the Defense Supplies Corporation (DSC), would operate the pipeline (Castaneda and Pratt 1993:21-22).

The RFC, which had been organized in 1932, was authorized to extend financial aid to agriculture, commerce, and industry through direct loans to banks and other credit agencies. During World War II, the RFC was given the responsibility for financing the production of planes, tanks, and guns; the stockpiling of strategic metals and materials; and the building and equipping of war plants. The DPC was organized on August 23, 1940, to finance and supervise the constructing and equipping of industrial facilities under the national defense program. Other government agencies responsible for administering defense and war programs sponsored the projects built by the DPC and selected the private firms that would operate them. The DPC then entered into agreements with these private firms for the design, purchase, and construction of the facilities, which the firms then leased and operated. The DSC, organized on August 29, 1940, was intended to be a catch-all agency for programs in which the RFC was not already involved. In addition to materials procurement (primarily aviation fuel), the DSC managed petroleum and coal transportation (Zaid 1973:n.p.).

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The WEP, which would build and operate the 24-inch- and 20-inch-diameter pipelines, was incorporated in Delaware on June 25, 1942, by 11 private oil companies. The WEP had a nominal capitalization and a provision in its charter that prohibited the corporation's stockholders from accruing any profit from the enterprise. Government supervision and restrictions were more stringent for the WEP than for other commercial enterprises. The stockholding companies were the Standard Oil Company of New Jersey, the Texas Pipe Line Company, Cities Service Oil Company, the Socony-Vacuum Company, the Gulf Oil Corporation, the Consolidated Oil Corporation, the Shell Oil Company, the Atlantic Refining Company, the Tide Water Associated Oil Company, the Sun Oil Company, and the Pan American Petroleum and Transportation Company. An 11-member board of directors, all of whom were executives in the stockholding companies, chose the officers of the WEP, subject to the approval of the DPC and DSC (Castaneda and Pratt 1993:22; Burt E. Hull Correspondence Files, June 1, 1943).

The 11 stockholding companies also pooled their personnel to construct and operate the pipelines. W. Alton Jones, the president of Cities Service Oil Company and the chairman of the Transportation Committee of the Petroleum Industry War Council, assumed the presidency of the WEP. Burt E. Hull served as the WEP's vice president and general manager, supervising construction of the pipelines. Before taking on his duties at the WEP, he had headed the Texas Pipe Line Company. Major A.N. Horne was the WEP's vice president and assistant general manager, loaned by the army to assist in the design, construction, and operation of the pipeline. Formerly the president of the Empire Pipe Line Company of Oklahoma, Major Horne was one of the nation's leading pipeline engineers. The WEP's chief engineer was Oscar Wolfe, formerly a chief engineer with the Texas Pipe Line Company. The general superintendent of the WEP was O.R. Burden, formerly the general superintendent of the Texas Pipe Line Company (Castaneda and Pratt 1993:22; *Pipe Line News* 1943:9).

The WEP began executing construction agreements with the DPC on June 26, 1942, the day after its incorporation. The initial contract was for the construction of the "Big Inch Line" from East Texas to a railroad loading terminal in southern Illinois. A supplemental agreement in November 1942 covered the extension of the 24-inch-diameter pipeline to a junction near Phoenixville, Pennsylvania, with 20-inch-diameter branch pipelines to the New York and Philadelphia refinery areas.

The year 1942 ended with a better outlook than when it began. The amount of oil carried by railroad tank cars had steadily increased. More oil was obtained from foreign sources, such as Venezuela, and refineries were built in the Middle East. Most importantly, oil began flowing through the Big Inch Line between Texas and Illinois on New Year's Eve. Despite the improvements to transportation and distribution, however, the PAW's Weekly Supply Bulletin reported in January 1943 that the "severity of the east coast supply condition remains unrelieved" (Frey and Ide 1946:4). Although more oil reached the East Coast after the completion of the Big Inch Line in June 1943, petroleum products remained in short supply for the civilian population as more and more was siphoned off for the war effort (Frey and Ide 1946:5).

In February 1943, the construction agreement covering the first section of the "Little Big Inch" 20-inch-diameter products pipeline was signed. The pipeline extended from the refinery areas near Houston and Beaumont, Texas, to a point near Little Rock, Arkansas, from which point the Little Big Inch Line used the same right-of-way as the Big Inch system (WEP 1943:9).

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Upon completion, the Big Inch and Little Big Inch pipelines were leased by the DPC to the DSC. The DSC appointed the WEP as its agent to operate the pipelines. While the DSC, as the lessee of the two pipeline systems, was responsible for their operation, actual movement of petroleum and petroleum products through the pipelines was delegated by President Roosevelt under Executive Order 9276 to the Petroleum Administrator for War, Harold Ickes. The Petroleum Administrator issued Directive 63 on January 20, 1943, directing the method of operation of the Big Inch Line, and issued Directive 73 on September 30, 1943, directing the method of operation of the Little Big Inch Line (WEP 1944:32).

Each month the Petroleum Administrator for War issued schedules designating the types, quantities, and sources of petroleum and products to be transported during the succeeding month, and also designated to whom the petroleum would be delivered on the East Coast. The WEP, acting as the agent for the DSC, purchased the designated petroleum from the designated sources. The WEP made purchase payment with funds supplied by the government. The WEP billed the East Coast customers, but checks were deposited to the credit of the DSC. Each month the WEP submitted a budget to the DSC showing the approximate amounts required for operations and the purchase of petroleum. The DSC then authorized the budgeted amount as credit with the Federal Reserve Bank. The Federal Reserve Bank in turn deposited money in private banks from which the WEP could withdraw to pay operating expenses, e.g., payroll and supplies. The purchase of crude oil or petroleum products came directly from government funds (WEP 1944:32-35).

Building the Inch Lines

Planning

The first plans for a transcontinental pipeline had been developed by the oil industry in spring 1941 (see above). Following the transfer of 50 oil tankers to the British to assist in their acute oil shortage, the industry realized that a pipeline was the only practical solution for moving the necessary quantities of oil from the source of supply in the Gulf of Mexico to the centers of consumption on the East Coast. The industry organized an engineering committee and began the task of identifying a route and preparing a conceptual design. Aerial photographs were taken along the route, maps were prepared, and preliminary designs and plans for the pipeline itself were developed (Cathers 1943:1).

On June 26, 1942, the day after the WEP was incorporated, a contract authorizing construction of the first leg of the 24-inch-diameter crude oil pipeline was executed between the WEP and the DPC. The WEP opened an office in Little Rock, Arkansas, on July 3, and the engineering team that would oversee the planning, design, and construction of the pipeline was assembled. All of the information, plans, and engineering data previously compiled by the oil industry were donated to the DPC for use by the WEP. Two engineering firms were immediately hired to begin surveying the pipeline route, and within the next few days 15 fully equipped crews were in the field (Cathers 1943:2-3).

Engineering for the project was under the direction of Charles P. Cathers, supervising engineer for pipeline engineering at the DPC. Much of the credit for the design of the Inch Lines and the solutions to many of the difficult problems encountered have been attributed to Oscar Wolfe, chief engineer for the WEP. Wolfe worked under Burt E. Hull, vice president and general manager; Major A.N. Horne, vice president and general superintendent; O.R. Burden, assistant general superintendent; and W. Alton Jones, president of the

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WEP. An engineering advisory committee included L.M. Goldsmith of the Atlantic Pipeline Company, W.R. Finney of the Standard Oil Company of New Jersey, and C.H. Kountze of the Sinclair Oil Company. The 20-inch-diameter pipeline stations were designed by F.E. Richardson and L.F. Scherer under the direction of Oscar Wolfe, and electrical equipment design was provided by A.S. Munneke and J.L. Gates (Cleary 1942:48; Reed 1943b:158).

The plan that was developed called for a 24-inch-diameter pipeline to carry crude oil, beginning at Longview, Texas, and running northeast through Arkansas and Missouri to Norris City, Illinois, a distance of 530.36 miles, with a right-of-way width of 75 feet. This leg was to be constructed first to supply a tank-car loading facility at Norris City, from which point the oil would move by rail to the East Coast. A tank farm would be built at Norris City to provide storage, and a 5-mile-long branch pipeline between the facility and Enfield, Illinois, would connect with oil pipelines of the Illinois Pipe Line Company and the Texas Pipe Line Company. This 24-inch-diameter branch pipeline, known as the "Enfield Connection," would provide an additional delivery capacity of 50,000 barrels per day. Pumping stations would be constructed approximately every 50 miles along the pipeline to supply the necessary power to move the oil at the desired flow rate. Longview was designated Station No. 1, and Norris City was Station No. 11 (Cathers 1943:11).

Once the first leg of the pipeline was operational, a second leg, known as the eastward extension, was to be constructed. The extension would continue the 24-inch-diameter pipeline 721.76 miles to Phoenixville, Pennsylvania, where the pipeline would split into two 20-inch-diameter pipe laterals to serve refineries in the New York and Philadelphia areas. The New York lateral was 86.25 miles long and terminated in Linden, New Jersey; the Philadelphia lateral was 22.75 miles long and terminated in Chester Junction, Pennsylvania. On October 27, the RFC approved \$60 million for the eastward extension, and on November 12, the contract for its construction was signed between the WEP and the DPC. Along the 24-inch-diameter crude oil pipeline, 28 pumping stations were to be constructed:

Station No. 1: Longview, Texas	Station No. 14: Seymour, Indiana
Station No. 2: Atlanta, Texas	Station No. 15: Oldenburg, Indiana (Batesville)
Station No. 3: Hope, Arkansas	Station No. 16: Lebanon, Ohio
Station No. 4: Donaldson, Arkansas	Station No. 17: Circleville, Ohio (Five Points)
Station No. 5: Little Rock, Arkansas	Station No. 18: Crooksville, Ohio (Somerset)
Station No. 6: Bald Knob, Arkansas	Station No. 19: Sarahsville, Ohio (Summerfield)
Station No. 7: Egypt, Arkansas (Walnut Ridge)	Station No. 20: Wind Ridge, Pennsylvania
Station No. 8: Fagus, Missouri (Pollard)	Station No. 21: Connellsville, Pennsylvania (Uniontown)
Station No. 9-a: Oran, Missouri	Station No. 22: Rockwood, Pennsylvania
Station No. 9-b: Gale, Missouri*	Station No. 23: Chambersburg, Pennsylvania
Station No. 10: Lick Creek, Illinois	Station No. 24: Marietta, Pennsylvania
Station No. 11: Norris City, Illinois	Station No. 25: Phoenixville, Pennsylvania (Eagle)
Station No. 12: Princeton, Indiana (Oakland City)	Station No. 26: Lambertville, New Jersey
Station No. 13: French Lick, Indiana	Station No. 27: Linden, New Jersey

(Names in parentheses are the current station names.)

**Station No. 9-b was abandoned and its equipment moved and combined with Station No. 9-a following inundation during Mississippi River flooding shortly after completion of the pipeline to Norris City.*

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Upon completion of the 24-inch-diameter main crude oil pipeline, which became known as the "Big Inch Line," a second parallel line of 20-inch-diameter pipe was planned to be built alongside the 24-inch-diameter pipeline to carry refined petroleum products from the refineries along the Gulf Coast. The products pipeline, or "Little Big Inch Line," was designed to share the same pumping stations as the Big Inch Line (with separate pump houses and associated structures), beginning at Station No. 5 (Little Rock) and running east. Running in the other direction from Little Rock, the 20-inch-diameter pipeline would follow a separate route nearly due south to Beaumont, Texas, to gather petroleum products along the Gulf Coast. Seven additional products-line-only pumping stations would be built along this portion of the route, designated with letters A through G instead of numbers.

The 20-inch-diameter products pipeline stations south of Station No. 5 were:

- Station A: Baytown, Texas
- Station B: Beaumont, Texas
- Station C: Newton, Texas
- Station D: Many, Louisiana
- Station E: Castor, Texas
- Station F: El Dorado, Arkansas
- Station G: Fordyce, Arkansas

The 24-inch-diameter main pipeline was supplied by the Longview Feeder System, which consisted of four separate pipelines connecting privately owned carriers and refineries with the tank farm at the Longview Station. The four pipelines included an 8-inch-diameter pipeline, 1.2 miles long, and a 24-inch-diameter pipeline, 5.7 miles long, for gathering East Texas crude oil; a 16-inch-diameter pipeline, 9.7 miles long, for gathering West Texas crude oil; and a 12-inch-diameter pipeline, 7.2 miles long, for gathering Southwest Texas crude oil (Cathers 1943:6).

The 20-inch-diameter pipeline was supplied by the Baytown-Beaumont feeder system, which consisted of two separate systems connected with privately owned refineries in the Gulf area. The system was designed to handle gasoline, diesel oil, heating oil, and kerosene with minimal cross-contamination. The system was composed of 203.6 miles of pipe, ranging in size from 6 inches to 16 inches, connecting Products Station A at Baytown and Products Station B at Beaumont, with refineries near the stations as well as near Galveston, Texas, and Lake Charles, Louisiana. A small feeder-line pumping station was subsequently built at Lake Charles; it was not given a letter designation but was known simply as the Lake Charles Station (Reconstruction Finance Corporation [RFC] 1946).

Three "Emergency Stations" were constructed in Pennsylvania and New Jersey. Emergency Stations A and B were located in Montgomery County, Pennsylvania, and Somerset County, New Jersey, respectively, and consisted of an assembly of piping and valving known as a "manifold bypass." The purpose of the manifold bypass was to allow future station construction at these sites without interruption of the flow of oil. Emergency Station C was located at Chester Junction, Pennsylvania, and consisted of a manifold bypass for the purpose of dividing the stream of oil to the different refineries in the Philadelphia area. Additional buildings and equipment at the Chester Junction Station included a concrete-block sample building (which

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also housed controls for the Philadelphia distribution system), scraper boxes, and a sump shed (Cathers 1943:98, 99).

The New York delivery system consisted of approximately 15.8 miles of 12-inch-diameter pipeline and approximately 0.5 mile each of 8-inch- and 10-inch-diameter pipeline extending from the Linden Station to seven refineries and outlets in the Bayonne, New Jersey, area. The oil companies served included Socony Vacuum Oil Company, Sinclair Oil Company, Cities Service Company, Gulf Port Oil Company, Tidewater Associated Oil Company, Hartol, and Richfield.

The Philadelphia delivery system consisted of approximately 11 miles of 16-inch-diameter pipeline, 3.5 miles of 14-inch-diameter pipeline, and 2.9 miles of 12-inch-diameter pipeline connecting Emergency Station C at Chester Junction with refineries in the Philadelphia area. The oil companies served included Atlantic Refining Company, Gulf Oil Corporation, Socony Vacuum Oil Company, Sun Oil Company, and Sinclair Oil Company (Cathers 1943:100, 101).

Preparation for Construction

Every pipeline contractor with equipment capable of handling the pipe was asked to attend a meeting in Little Rock on July 11, 1942, to assist in the preparation of the construction program. The first leg of the project was divided into eight construction sections. The length of each section was between 50 and 60 miles, depending on the nature of the terrain and hence the difficulty of construction. To assure completion of all sections by December 1942, river crossings (which required special construction techniques) and the branch pipelines at Longview and Norris City were contracted separately. Because of a multitude of unpredictable circumstances presented by the project as well as the war, contractors were hired under a cost-plus-a-fixed-fee agreement rather than the more customary lump-sum arrangement. The construction agreements between the WEP and the contractors were signed on July 15, 1942, and approved by the DPC the same day. Approximately 35,000 purchase orders would ultimately be issued and over 200 agreements negotiated with 82 construction contractors carrying over 16,000 men on their payrolls. The WEP organization was operated out of offices in Little Rock from July 8, 1942, until February 1, 1943, when the office moved to Cincinnati to be closer to the construction of the eastward extension (Cathers 1943:4, 21).

Pipeline Construction

Construction of the pipeline consisted of receiving and moving materials to the construction site; clearing and grading the right-of-way and excavating the trench (called ditching); cleaning, welding, bending, and coating the pipe; and setting the pipe in the trench and backfilling. In addition, pumping stations were constructed at intervals averaging about 50 miles. Station features included pump houses, power supplies, employee housing, storage tanks, and special piping and valves, plus six to 10 other support buildings and structures per location.

The first purchase order, for 137,500 tons of 24-inch-diameter pipe, was placed on July 2, 1942. Two weeks later the first trainload of pipe was shipped to Little Rock by the National Tube Company. The entire project

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would ultimately require 21,185 railcar-loads of pipe. Another nearly 4,000 carloads of other materials would be delivered, bringing the total weight of materials for the job to 725,000 tons (Cathers 1943:21).

The pipe used in the construction of the Big Inch Line consisted of 24-inch-diameter seamless steel pipe weighing 94.62 pounds per foot with a wall thickness of 3/8 inch. A total of 135,700 tons of pipe were required for the first section of the pipeline to Norris City, and 225,000 tons for the second section. The Big Inch Line's distinction as the biggest, heaviest, and longest pipeline built up to that time presented challenges to the builders. The individual pipe sections averaged 38 to 44 feet in length and weighed between 3,800 and 4,200 pounds. Only the largest D-8 side-boom Caterpillar tractors were capable of lifting and lowering the sections into the trench, and even these machines required the addition of heavy counterweights to prevent them from tipping over. The Little Big Inch Line was built with 20-inch-diameter pipe, of which approximately 1,000 miles consisted of 5/16-inch-wall electric weld pipe, approximately 456 miles of 5/16-inch seamless pipe, and approximately 7 miles of 1/2-inch-wall seamless pipe (Cleary 1942:43-46).

Pipe Laying

The laying of pipe began on August 3, 1942, near Little Rock. By September 10, all eight pipe-laying crews, each consisting of between 300 and 400 men, were in the field working. Under favorable conditions a crew could complete over a mile of pipe per day. Each crew required a complement of equipment valued, at that time, between \$250,000 and \$300,000. The delivery of the contractors' equipment to the job sites over the course of the job required 2,400 freight cars (Cathers 1943:10, 21).

The pipe was unloaded using a side-boom tractor, which picked the sections off the delivery trailers and placed them on the ground end to end. In contrast to the practice with smaller pipe, which was sometimes simply rolled off, use of the side-boom tractor ensured that the ends of the pipe were not damaged, which could result in faulty welds. The inside of the pipe was swabbed clean by a man who was pulled through the pipe on a cleaning pad and who also used hand rags (Cleary 1942:45, 46).

The pipe trench or "ditch" was dug with a rotary-wheel-type ditching machine where soil conditions permitted. In rock and other hard material, backhoes, shovels, and cranes were employed. Occasional hand work was required to clear material that collapsed in the trench before welding or the installation of valves was completed. In all, roughly 7 million cubic yards of material were excavated (Cathers 1943:9).

Wherever the pipe crossed under a highway or railroad line, the pipe was "cased" within another pipe of slightly larger diameter. A tunnel was first bored under the road, the casing was jacked through, and the main pipe was pushed through the casing. The casing was welded to the pipe at each end and vented to prevent the buildup of vapors in the space. The crude oil pipeline crossed under railroads at 289 points and under highways at 626 points (Cathers 1943:8, 11).

River crossings required different construction techniques and were therefore contracted separately from the main pipeline to companies with the experience and equipment necessary for underwater pipe laying. The crude oil pipeline required 33 river and stream crossings, with another 16 crossings on the feeder and distribution pipelines. Barge-mounted clamshell-bucket dredges, drag-line buckets, and suction dredges

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were used to excavate the underwater trench for the pipeline. When rock was encountered, underwater blasting with dynamite was employed. Despite its weight, the pipeline floated when empty; this necessitated the placement of 4,800-pound "river clamps" approximately every 30 feet to anchor the pipe adequately to the bottom. On welded pipe joints to be located underwater, a short section of larger pipe was welded in place overlapping the joint to form a protective and reinforcing sleeve. Priming, wrapping, and coating the pipe was much more involved than with land pipe (see below), and elaborate measures sometimes had to be taken to protect the coating from damage during the pipe-laying operation (Cathers 1943:12, 13).

During construction of the Mississippi River crossing in late December 1942, heavy rains and flooding led to the destruction of the crossing just two days prior to its completion. The replacement crossing was constructed with heavier pipe with a 1/2-inch wall thickness rather than the standard 3/8-inch mainline pipe (Cathers 1943:6).

Record rainfalls hit Arkansas in May 1943, causing record flooding of the Arkansas River. Just below Little Rock, the Arkansas River tore a new channel 1/2 mile wide and 35 feet deep. The crude oil pipeline, in operation to Norris City, was left suspended in the torrent, which snapped the pipe in two places. A nearby crew building the 20-inch-diameter products pipeline rushed to the scene and, with the use of Army Corps of Engineers equipment, rebuilt and rerouted 8 miles of the pipeline, this time crossing the river by suspending the pipeline from the Rock Island Railroad Bridge at Little Rock (Cathers 1943:11).

Conditions in the vicinity of Linden, New Jersey, presented numerous obstacles to the construction of the New York area branch delivery pipelines. These lines, totaling 16 miles of 12-inch- and 14-inch-diameter pipe, connected the Linden Station with refineries at Bayonne, Bayway, Carteret, Tremley Point, and Perth Amboy. The tidal marshes that had to be crossed could not support heavy equipment, and in most places earthen fill was either dredged or trucked in to create a raised bed for the pipe. In Bayonne, roughly 3,000 feet of horizontal boring was required to install pipe beneath streets and railroad tracks. River and bay crossings required about 4 miles of submarine pipeline construction. The Army Corps of Engineers required the Newark Bay and Arthur Kill river crossings to be laid 42 feet below mean low tide, 13 feet deeper than originally planned (Cathers 1943:13-14).

Welding

Depending on the preference and practice of the individual pipeline contractors, the pipe was welded and laid using one of two different methods, known as the stovepiping method and the roll-weld method. Each method had its advantages and disadvantages, which varied depending on equipment and conditions. The primary difference between the two methods was the manner in which new pipe sections were added to the line and the pipe-bending methods employed. In the stovepipe method, pipe sections were added one at a time, and hot bending was required. In the roll-weld method, three to six sections were first joined together to form a "string" and then welded to the pipeline. Cold bending of the string was accomplished before it was welded to the pipeline. Considerable debate raged between the contractors as to the superior method in terms of quality and efficiency (Cathers 1943:8; Cleary 1942:46).

In the roll-weld method, also called the firing-line method, up to seven sections of pipe were aligned alongside the trench, resting on supports equipped with rollers. The pipe sections were rotated or rolled as they were welded, permitting the welder to work in an upright position and weld vertically. On flat, straight runs, the string might consist of seven sections and exceeded 275 feet in length. When completed, the string was carried to and lowered into the trench by a series of large side-boom tractors (Cathers 1943:9).

Stovepiping, on the other hand, was a holdover term and technique from earlier days (circa 1930), when oil-line pipe to be welded was manufactured with a flared end and slipped over the adjoining pipe like a stovepipe. In this method, the previously laid pipe and the pipe section to be added were supported on wood cribbing directly above the trench. The welder would weld vertically, horizontally, or overhead as he laid the continuous bead of weld around the pipe. This involved considerably more welding skill and discomfort to the welder than the roll-weld method; however, less and lighter equipment was required (Cathers 1943:9).

In both methods, the ends of the pipe to be joined were aligned, drawn together, and spot welded in several places to hold the joint in alignment. A skilled pipe welder then performed a three- or four-pass weld to join the pipe using the electric shielded arc rod, or "stick," welding method. The first weld was made with a 3/16-inch electrode at a welder setting of 200 amperes. The second weld used a 1/4-inch electrode and the third a 5/16-inch electrode, both at a setting of 325 amperes. In the roll-weld method, a single welder completed the welding of the entire connection; in the stovepipe method, often two welders worked each side of the pipe. When done, the welder finished by welding his initials or mark on the joint to fix responsibility for the quality of the work. On average, a welder completed a joint in one hour for the 24-inch-diameter pipe and in 48 minutes for the 20-inch-diameter pipe (Cathers 1943:9; Cleary 1942:45; Taylor 1943:196).

Each joint required between 18 and 24 pounds of welding rod and an estimated 140 welded joints per mile, plus other welding at manifolds and stations; approximately 600 tons of welding rod were used on the entire Big Inch Line (Cathers 1943:9). Upon completion of a joint, the welds were cleaned by hand with a wire brush to remove all flux and minimize pitting and corrosion (Cleary 1942:46).

Bending

To adjust for changes in the vertical and horizontal alignment of the pipe, the pipe was bent to fit in the field using both hot and cold bending methods. On long straight runs, short horizontal curves or "kinks" were also constructed in the pipeline to absorb the expansion and contraction of the pipeline caused by temperature changes (Cleary 1942:45).

In the construction of the 24-inch-diameter pipeline between Longview and Norris City, roughly half of the pipe was constructed with the firing-line method and cold bends, and half with the stovepipe method and hot bends. The standard method of cold bending required three large tractors, one equipped with a bending shoe and located in the center of the bend and two at each end to push in the opposite direction. A long string of pipe (two or more sections) provided the necessary leverage to make the bend on large-diameter pipe (Reed 1943a:180).

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The stovepipe method required bends to be made in a single joint of pipe (40 to 50 feet long) before it was joined to the line; in the field, this was only accomplished by softening the steel with heat prior to bending. On the eastward extension of the 24-inch-diameter pipeline, several contractors made use of pipe sections pre-bent by the pipe factory. The hot bends were accomplished with a piece of equipment designed for the purpose, consisting of a curved steel heat shield attached to a steel A-frame jig. A kerosene-fired blowtorch was directed between the pipe and the shield while winch-drawn cables attached to the end of the pipe and drawn over the A-frame performed the bend (Reed 1943a:180, 182).

Shortly after the beginning of construction of the Big Inch Line, J.D. Cummings of Crutcher-Rolfs-Cummings invented a cold-pipe-bending machine known as the Cummings bending jig. Paul Reed of the *Oil & Gas Journal* called the invention "the principal innovation developed in the course of construction of the War Emergency Pipelines" (Reed 1943a:180). Basically, the jig consisted of a series of 20 iron bending shoes connected by a heavy spring and mounted on a skid frame. The jig substantially reduced the equipment and time required for cold bending, resulting in a savings of up to \$1 million on the construction of the 20-inch-diameter pipeline (Reed 1943a:182).

Coating and Wrapping, Placing, and Backfilling

Following welding and bending, the exterior of the pipe was cleaned, and a specially developed three-part coating was applied to prevent corrosion. The substantial expense of the elaborate coating process, which required the use of specialized machines for its application, was justified by the fact that protection against corrosion assured negligible depreciation and a high future value of the pipeline. This forethought greatly served American taxpayers when the pipeline was sold after the war for the full cost of its construction (Cleary 1942:46).

The pipe was cleaned and primed with a gasoline-engine-powered, self-propelled machine designed for the task. The machine attached around the pipe and traveled along it at a rate of 40 feet per minute while scrubbing the pipe with rotary wire brushes and then applying a 3/32-inch-thick layer of coal-tar enamel with special swabs (Cleary 1942:46). A total of 16,500 tons of pipe enamel were applied in this manner to the Big Inch Line (Cathers 1943:8).

A second machine followed several hundred feet behind the first and applied a hot coal-tar coating, which served as a bonding primer for a cold-applied, spirally wound wrapping of 15-pound tar-saturated asbestos felt. On the Big Inch Line, this work required a total of 62,000 gallons of coal-tar primer and 30 million square feet of coal-tar-saturated felt. It should be noted that, because of the difficult terrain from Somerset in eastern Ohio to a point about 30 miles west of the Susquehanna River in Pennsylvania (approximately 280 miles), no coating was applied to either pipeline in this stretch except at certain locations, such as river crossings (Cathers 1943:8; Cleary 1942:46).

The pipe was then carefully lowered into the trench by side-boom tractors. Wood blocks were placed between the cable slings and the pipe to prevent damage to the coating. The final step in the construction was to backfill the trench using conventional loaders, graders, and bulldozers.

Despite delays in the delivery of gate valves (to be placed at pumping stations, river crossings, and other critical points as emergency shutoffs), the first leg of the 24-inch-diameter pipeline to Norris City was completed on January 11, 1943. The first crude oil, which had been started into the line on December 31, 1942, was received on February 13, 1943. On April 27, 1943, construction of the 20-inch-diameter pipeline began. The final weld on the Big Inch Line was made at a ceremony at the Phoenixville Station on July 19, and the final weld on the Little Big Inch Line was made on December 8, 1943, in Crooksville, Ohio (Cathers 1943:6; WEP n.d.:n.p.).

Pumping Station Construction

Construction of the Big Inch Line pumping stations and power transmission lines did not begin until November 1, 1942, because of difficulties in acquiring the land for the 28 stations. The stations were of nearly identical design, layout, and equipment, with minor modifications because of site conditions, material availability, or the location of storage tanks and associated equipment.

Each station consisted of separate pump houses for the crude oil and the products pipelines, an electrical substation to provide the huge power requirements for the pumps, and a varying number of support buildings depending on the station type. All stations had separate or combined sample-firehouses, a garage or combination garage-warehouse, a well house, separate sump sheds for the crude and products pipelines, hay filters, and burn pits. Office buildings were located at the Longview, Norris City, and Linden stations. A detailed description of a station layout, as well descriptions of each surviving type of Inch Lines building and structure, are contained in the individual-resource narratives of this report.

The design of the Norris City Station (No. 11), the terminus of the first leg of the construction, called for special facilities for the storage of crude oil and the transfer of the crude oil to railroad tank cars. This dictated a much larger pump house to accommodate the additional pumps required to fill and empty the storage tanks and supply the tank-car loading racks. By the time the Norris City design was put on paper in late 1942, the wartime steel shortage had grown more acute, and the materials of the pump house were changed from all steel to wood framing with asbestos roofing and siding. Similarly, all of the pump houses that followed Norris City on the eastward extension of the 24-inch-diameter pipeline, as well as all of the pump houses built for the 20-inch-diameter products pipeline, were of the same basic wood and asbestos design.

Construction Contractors

The following contractors were associated with the building of the Inch Lines:

Pipeline Contractors:

Anderson Brothers, Little Rock, Arkansas, 190 miles
W.A. Bechtel Company, San Francisco, California, 65 miles
O.E. Dempsey Construction Company, Tulsa, Oklahoma, 166 miles
Exeter Construction Corporation, Camp Hill, Pennsylvania, 41 miles
Charles S. Foreman Company, Kansas City, Missouri, 135 miles

I.C. Little, Dallas, Texas, 44 miles
Jones & Brooks, Oklahoma City, Oklahoma, 37 miles
Midwest Engineering and Construction Company, Tulsa, Oklahoma, 45 miles
Oklahoma Contracting Company, Dallas, Texas, 313 miles
Sheehan Pipe Line Construction Company, Tulsa, Oklahoma, 112 miles
Ray L. Smith Construction Company, Eldorado, Kansas, 96 miles
O.C. Whitaker, Fort Worth, Texas, 44 miles
Williams Brothers Corporation, Tulsa, Oklahoma, 160 miles

Major River Crossings:

Williams Brothers Corporation, Tulsa, Oklahoma
Charles S. Foreman Company, Kansas City, Missouri

Pumping Stations (to Norris City):

Williams Brothers Corporation, Tulsa, Oklahoma
Sheehan Pipe Line Construction Company, Tulsa, Oklahoma
Midwest Engineering and Construction Company, Tulsa, Oklahoma

Storage Tanks:

Graver Tank & Manufacturing Company, East Chicago, Illinois
Pittsburgh-Des Moines Bridge & Iron Company, Pittsburgh, Pennsylvania
Steel Tank Construction Company, Dallas, Texas

Field Surveys:

Huey & Cage, Monroe, Louisiana, 620 miles
Lockwood, Kessler & Bartlett, Brooklyn, New York, 461 miles
Midwest Engineering and Construction Company, Tulsa, Oklahoma, 330 miles

Pipe Manufacturers:

National Tube Company, Pittsburgh, Pennsylvania
A.O. Smith Corporation, Milwaukee, Wisconsin
Republic Steel Company, Youngstown, Ohio
Youngstown Sheet & Tube Company, Youngstown, Ohio
Jones & Laughlin Steel Company, Pittsburgh, Pennsylvania

Publicizing the Inch Lines

By the 1940s, Hollywood had been the dominant force in world film production for two decades. It had an unmatched capacity to produce films that propagandized while they entertained. Approximately 80 million Americans attended films each week, and the moviegoing audience cut across class, regional, and ethnic lines. President Roosevelt declared that motion pictures could be very useful in contributing to the war effort. After Pearl Harbor, newsreel companies devoted roughly three-quarters of their screen time to coverage of the war (Roeder 1993:4, 18), although newsreel companies differed significantly in their style

of news coverage. The Office of War Information, formed in June 1942, carefully monitored newsreels and had considerable influence on what stories they featured. In addition, the Office of War Information's Bureau of Motion Pictures served as a liaison with the Hollywood film industry. The Bureau also distributed films put out by assorted agencies and produced a number of its own for commercial release and for nontheatrical distribution (Winkler 1978:57).

Newsreels documented the progress of pipeline construction with such title cards as *Pipe Line Goes Through!* and *Pipe Dream Comes True-Oil!*. When the pipeline reached the Norris City Station, a news clip showed the opening of the gate valves and the loading of oil onto railroad tank cars. In 1943, newsreels showed Harold Ickes and other dignitaries dedicating the Big Inch Line at Phoenixville, Pennsylvania (Paramount News 1942, 1943).

Short movies were also produced that emphasized the importance of the Big Inch Line. One of these was a 10-minute film entitled *Pipeline*, produced by the Overseas Branch of the Office of War Information. It began with shots of prewar methods of oil transportation, such as tankers and railroad tank cars. The film then traced the progress of the pipeline's construction, beginning with the aerial survey. It included shots of the most challenging section of the pipeline through the Appalachian Mountains and finished with the opening of the gate valves (Office of War Information 1943).

A more melodramatic depiction of the war's reliance on oil was an eight-minute film produced by RKO Pathe entitled *Oil is Blood*, in which the narration and music whipped up patriotic fervor. This film devoted a 70-second segment to the story of the Big Inch Line's construction (RKO Pathe circa 1943).

Putting the Inch Lines in Service

Crude oil was first pumped into the Big Inch Line extension from Norris City on July 14, 1943. It arrived in Phoenixville on August 14, the same day as the last weld on this segment was completed, and less than a year after construction had started. That same day, oil was delivered to the refineries in the Philadelphia area, and exactly one week later, the Linden Station received its first oil (Cathers 1943:24). On October 28, 1943, the process of filling the products pipeline with water for the purpose of hydrostatic testing was begun between Beaumont and Norris City. The final weld was made on December 2 of that year. Gasoline was pumped into the pipeline at Beaumont on January 26, 1944, pushing the water ahead of it into the eastward extension for testing of that section. Defective welds were found in several instances on the eastward extension, and their repair delayed the startup of full operation until March 2, when the head of the gasoline stream arrived at the Linden Station (WEP n.d.:n.p.).

During the first year (ending April 1, 1945) that both Inch Lines were in full operation, a total of 185,122,264 barrels of oil were pumped through the two pipelines. Of that volume, the crude oil pipeline pumped 112,456,166 barrels for a daily average of 308,099 barrels. This volume greatly exceeded the original design estimates of 290,000 barrels per day. The products pipeline pumped 72,666,098 barrels of the total for a daily average of 199,085 barrels (Cathers 1943:18; King n.d.:66).

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Increased flow was obtained through the pipelines in a variety of ways. A small increase was obtained by hydraulically balancing the line. This was done by enlarging the impellers on one or more of the pumps in the stations where the discharge pressure was not high enough to keep the load from shifting to the other stations. The larger impellers required boosting the motor horsepower to 2,000, which was done by rewinding the motor armatures (King n.d.:66). Another increase in the output of the 24-inch-diameter pipeline was achieved by increasing the line pressure east of Norris City to over 800 pounds per square inch (psi). The increase in power required was met by increasing the voltage supplied to the motors from 2,300 volts to between 2,400 and 2,500 volts, which forced the motors to operate at 110 percent to 125 percent of their rated load but did not result in serious overheating (King n.d.:66).

Security was a concern while the pipeline neared completion, and during the first months of operation as many as 18 armed guards were stationed at each of the tank farm stations. Once construction of the products pipeline was completed and the stations were secured with fencing, one armed guard was stationed at the gate of each station (Cathers 1943:16).

The WEP was one of America's largest wartime consumers of industrial power. The Big Inch and Little Big Inch pipeline pumping stations had a total connected load of about 250,000 horsepower, and consumed at peak load over 121.5 million kilowatt hours (kwhr) per month. During the first year (ending April 1, 1945) that both Inch Lines were in full operation, the WEP consumed a total of over 1.28 billion kwhr. The power was purchased at an average of 0.7 cents per kwhr, resulting in a total annual electric cost of nearly \$9 million. Of the total, roughly \$5.25 million was charged to the 24-inch-diameter crude oil pipeline and \$3.73 million was charged to the 20-inch-diameter products pipeline (King n.d.:64, 66).

Postwar Disposal and Conversion

Government Disposal of the Inch Lines

In November 1945, after the end of the war, the Big Inch and Little Big Inch pipelines were retired and placed on standby. They remained under the control of the WEP until February 1, 1946, when the Williams Brothers Construction Company was hired to maintain the lines. The War Assets Corporation (later the War Assets Administration), a subsidiary of the RFC, was given the assignment of disposing of all federal surplus war property. The RFC turned over custody of the Big Inch and Little Big Inch pipelines to the War Assets Administration on December 2, 1946. On that same day, the pipelines were leased to the Tennessee Gas Transmission Corporation so that a fuel shortage caused by a coal strike could be alleviated. This use of the Inch Lines for gas transmission involved no physical changes: the gas was moved through the pipelines only by pressure originating at the wellhead.

Harold Ickes, testifying before the House Surplus Property Investigating Committee, urged the government to dispose of the pipelines as quickly as possible. He felt that the combination of depreciation and rising maintenance costs would render the pipelines worthless if inaction prevailed. Ickes testified that natural gas was an energy resource that could not be wasted at a time when many of the natural resources that had been this country's industrial and military foundation were being depleted (Ickes 1946:4-5).

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The government initially put the pipelines up for sale with the reservation that they be used to carry petroleum. This restriction was the result of lobbying by coal interests trying to prevent the transmission of natural gas to the East. Sixteen companies submitted bids.

In March 1946, a congressional subcommittee on the postwar disposal of pipelines issued a statement in which it adamantly disagreed with the conclusion of the Surplus Property Administration (forerunner of the War Assets Administration) that the Big Inch and Little Big Inch pipelines remain oil pipelines. The subcommittee contended that the pipelines would need to operate at full capacity to justify the operating costs, and full loads were not available because of the reactivated government-owned tanker fleet. Instead, the subcommittee recommended that the Big Inch and Little Big Inch pipelines be converted to natural gas, a commodity which the East Coast sorely needed (Subcommittee on Pipe Lines 1946:1-3).

In November 1946, notwithstanding the subcommittee's findings, the War Assets Administration was ready to award the Big Inch and Little Big Inch pipelines to Big Inch Oil, Inc., the highest of the 16 bidders, for \$110 million. Then Robert M. Littlejohn, head of the War Assets Administration, surprised everyone by rejecting all the bids on the grounds that they were too low. Several factors had influenced Littlejohn's decision. The War Assets Administration had based its preference for petroleum carriers in part on the recommendations of the Army-Navy Petroleum Board, but in October 1946 the board issued a statement of neutrality regarding the choice of gas or oil. Of more immediate concern was a scheduled appearance by Littlejohn before a congressional committee convened to investigate the financial negotiations in the bidding process for the disposal of the pipelines. The general public, already favoring the selection of gas transmission, was galvanized in its support by a coal strike that cut off energy supplies from the East Coast in November 1946 (Taylor 1946:21-22). Thus, bidding for the pipelines was reopened to include natural gas carriers. To ensure that the pipelines would be available in another national emergency, the successful bidder would be required to comply with a dormant estate clause stipulating that the pumping facilities must be maintained for 20 years in a state capable of being immediately reconverted to oil transportation if necessary.

Texas Eastern Transmission Corporation (TETCO) was incorporated in Delaware on January 30, 1947, for the express purpose of bidding for the purchase of the Big Inch and Little Big Inch pipelines. The idea for forming TETCO originated with E. Holley Poe, an Oklahoma-born gas consultant. He interested George R. Brown and his brother, Herman, in the company. The Brown brothers owned a large international construction firm, Brown and Root. They had been involved in the construction of pipelines for many years and also had extensive oil- and gas-producing properties, as well as connections in banking. The three men put together the founding group, which included Everett De Golyer, one of the world's leading oil geologists. Another early investor was Charles Francis, a partner in a Houston law firm with connections in Washington. Francis helped the fledgling corporation deal with Congress and the Federal Power Commission (FPC). Reginald Henry Hargrove, a United Gas Pipe Line Corporation executive, was brought in to operate the pipeline (Hargrove 1988a:7-8).

A crucial element in the bidding process was the treatment of the oil pumping stations. The main bidding competitors, the Tennessee Gas Pipeline Company and the Transcontinental Pipeline Corporation, treated the stations as an economic drain, held idle for possible petroleum use and therefore not part of the rate base

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used for regulatory purposes, whereas TETCO decided to convert the stations, retaining the same electric motors that had driven the oil pumps. Since most of the facility would be used in the transmission of natural gas, it could be included in the rate base. Another reason TETCO was able to outbid its competitors was that the founders thought they would be able to sell the gas at a higher rate than their competitors believed possible. The TETCO founders estimated that their competitors would put in a bid at around \$130 million. They decided to top that by 10 percent, resulting in an amount of \$143 million. Somewhat apprehensive about submitting a round number, they tacked on \$127,000 to come to the final bid of \$143,127,000 (Hargrove 1988a:9-14).

TETCO's founders advanced \$250,000 to the new company for startup costs involving engineering, planning, and bidding. All of the founders made a substantial paper profit when TETCO's stock went public (*Time* 1947:89). TETCO had originally capitalized at \$150,000 contributed by 28 stockholders, 12 of whom were associated with the New York investment banking firm of Dillon, Read & Company, Inc. Of this amount, \$100,000 was required as a good faith amount in making the bid. TETCO borrowed additional money from stockholders and banks to come up with \$5 million for the down payment and the construction of compressor stations. The balance of \$138,027,000 would be due on November 25, 1947, when title to the pipelines was transferred. During the first four months TETCO operated the pipelines as a lessor, it earned \$764,000. The company estimated that earnings would rise to \$7,500,000 a year. It offered \$120 million in 3½-percent First Mortgage Pipeline Bonds to a group of 12 insurance companies. Other investors were offered 3,564,000 shares of common stock at \$9.50 per share. The bonds and the shares of common stock immediately sold out (*Newsweek* 1947:70).

The bid was awarded to TETCO on February 8, 1947. They were required to take possession on May 1 by an interim lease and to pay \$4 million. Title was conveyed in November 1947. It was the largest sale of war surplus made to the private sector (*Times-Herald* 1947). TETCO was faced with an enormous undertaking between February and November. It was necessary to build an organization from scratch to operate the system. Contracts for gas purchases and gas sales needed to be negotiated. Hearings before the FPC were necessary to get a Certificate of Public Convenience and Necessity. TETCO also needed Congress to grant it the right of eminent domain in interstate commerce in order to acquire the rights-of-way restricted to petroleum transportation (Hargrove 1988a:17). Brown and Root immediately set to work in May 1947 on the construction, which entailed laying some additional pipeline and building compressor stations and meter stations (Sentell 1988:11; Texas Eastern Transmission Corporation [TETCO] 1948:9). Although the Tennessee Gas Pipeline Company had operated the pipelines with a bare minimum of personnel, most of them were former WEP employees who stayed on to work for TETCO. This smoothed the transition when TETCO took over the pipelines on May 1 (Sentell 1988:3, 9).

The FPC gave TETCO a temporary Certificate of Public Convenience and Necessity so that operations could begin. All of TETCO's 268 employees on May 1, 1947, had been hired within the previous one and a half months, and the majority of its field personnel were former WEP employees. The WEP's division managers, with one exception, went to work for TETCO. Only 12 employees of the general office transferred from the former WEP headquarters in Cincinnati to the new TETCO headquarters in Shreveport in August 1947. TETCO had to hire executive personnel to run the company and build a new general office organization. By the end of 1947, TETCO had 107 employees in Shreveport (TETCO 1948:17-18).

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George R. Brown became TETCO's first chairman of the board, and E. Holley Poe became the first president. After the bid was awarded and TETCO became an operating corporation, Reginald Henry Hargrove, a former executive vice-president of the United Gas Pipe Line Corporation, became its president. He chose many of his former colleagues at the United Gas Pipe Line Corporation to become the operating personnel of TETCO (Hargrove 1988a:15).

Soon after TETCO was incorporated, its founders approached Norric McGowen, the head of United Gas Corporation of Shreveport, with an offer to become the majority interest holder in the enterprise. He declined, citing antitrust problems and a desire to remain focused on doing business in the Gulf region. Instead, McGowen agreed to furnish TETCO with 25 percent of its gas requirements and to let Reginald Hargrove move over to TETCO and help set up operations (Hargrove 1988a:8). Hargrove, a lifelong resident of Shreveport, saw the opportunity to create his own empire at TETCO rather than remain the second-in-command at United Gas. At the time of TETCO's organization, Hargrove was serving as president of the American Gas Association, which gave him many contacts among northeastern utility companies (Sentell 1988:26). Hargrove chose not to create the position of vice president in charge of engineering and operations. Instead, he met directly with engineers, allowing the design, construction, and operation of the new system to proceed more efficiently. Hargrove also involved himself in the gas purchasing end of the business (Hargrove 1988a:20; Shoup 1988:9-10). Reginald Hargrove was killed in a plane crash with other TETCO executives while returning to Shreveport from a duck hunting trip in 1954 (Parten 1988:15).

Initially, TETCO could only transport natural gas through the Inch Lines as far as Ohio. Pennsylvania refused to grant the necessary rights-of-way across rivers except for oil transportation. George R. Brown, chairman of the board at TETCO, blamed the coal industry, which had a firm hold on eastern fuel markets and did not relish the threat of competition from natural gas (*Oil & Gas Journal* 1947a:126). When TETCO filed an application with the FPC for a permanent certificate, the Commonwealth of Pennsylvania filed a notice of intervention. Pennsylvania intended to allow natural gas to be shipped only as far as the Pittsburgh area (*Oil & Gas Journal* 1947b:38).

The FPC opened hearings on July 7, 1947, in regard to TETCO's application to convert the Big Inch and Little Big Inch pipelines to natural gas transmission and to build and operate additional facilities. These hearings continued throughout July and August. In order to qualify for a permanent Certificate of Public Convenience and Necessity, TETCO had to prove that an adequate demand for its proposed natural gas service existed, that a supply of natural gas was available, that it was competent to render the service, and that the project as a whole was economically feasible. The FPC issued the permanent certificate on October 11, 1947, citing an urgent need for natural gas along the route of the Big Inch Line. This cleared the way for TETCO to acquire the pipelines from the government on November 1, 1947 (TETCO 1948:15).

In late September 1947, Pennsylvania relented and gave permission for the transmission of natural gas through the Big Inch Line. Pennsylvania removed its opposition after TETCO's counsel, David T. Searles, testified that capacity deliveries of the system would not have any appreciable effect on the sale of anthracite in the region. Searles also said that the Appalachian and Philadelphia areas needed all the natural gas they could get (*Oil & Gas Journal* 1947d:115).

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The WEP's status as agent of the RFC was officially terminated on July 16, 1947. The WEP promised to take the appropriate steps to dissolve itself immediately. Files pertaining to the WEP's corporate organization and functions were permitted to be retained by them, but all other files were to be turned over to the RFC (RFC 1947).

The RFC's chairman, John D. Goodloe, commented that the Inch Lines had surpassed military and economic expectations. The United States government had invested \$145 million in the Inch Lines, had netted approximately \$182 million from their operation, and was selling them for nearly the same amount as their capital investment. In addition, the government had saved about \$290 million in the cost of delivering oil to the East Coast by pipeline as opposed to tank cars (*Oil & Gas Journal* 1947c:43).

Conversion of the Inch Lines to Natural Gas Transmission

Baxter D. Goodrich, TETCO's chief engineer and a vice president, was charged with the complex job of converting the WEP system to carry natural gas. His task was to take pipelines, pumping stations, and other facilities which had been designed to carry crude oil or oil products and convert them for use in the transmission of gas in the most efficient and economical way possible, at the same time preserving the ability of the Inch Lines to be immediately reconverted to their original use in the event of national emergency. Goodrich, 37 years old at the time, had seven years of previous experience on new pipeline construction with the United Gas Pipe Line Corporation, and three wartime years with the Navy's Arctic petroleum expedition (Goodrich 1948:81; *Pipe Line News* 1951:4).

When operation of the Inch Lines by TETCO commenced on May 1, 1947, none of the facilities had been converted for gas operations. The gas moved through the pipeline under its own pressure without any mechanical assistance. Approximately 138 million cubic feet of gas per day were transported through the pipeline in this way. With increased capacity the prime objective, TETCO applied for and was granted authorization by the FPC to build 21 compressor stations with an aggregate total of 153,000 horsepower, calculated to increase the capacity of the pipeline to 433 million cubic feet of gas per day (TETCO 1954:8). The immediate need for gas was in the Appalachian region, where regional supplies were failing to meet the increasing demands of industry in the area.

Centrifugal compressors were installed at 16 pumping stations, and reciprocating compressors were installed in the remaining five out of the 21 stations approved by the FPC. This work started promptly, and before the end of 1947, TETCO had designed, built, and begun the operation of two centrifugal compressor facilities at the Little Rock and Batesville stations (*Pipe Line News* 1951:4). At each of these stations, six Ingersoll-Rand compressors were installed, three in each of the two pump houses. In addition, two reciprocating compressor stations were erected in new buildings at the Oran and French Lick stations.

A quantity of natural gas is measured in units of cubic feet at a certain pressure. As the pressure (by compression) on a gas increases, the volume of the gas decreases. The result of this property of gas is that huge volumes of gas may be compressed into containers, such as pipelines and storage tanks, providing they are designed to withstand the pressure. Naturally, those involved at the beginning of the TETCO project to convert an oil pipeline to a gas line understood the potential of a very-large-diameter pipe designed to

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operate at extremely high pressures in excess of 800 psi. In fact, the pipeline itself had the potential to move far greater quantities of gas to the Northeast, or to points along the route, than the demand required at the time. Additional, more powerful, and more efficient compressors could be continually added to the pipeline to increase its capacity. The question was whether a market would develop for the immense volumes of gas the pipelines were capable of delivering.

The centrifugal compressor was a great success and proved to be extremely well suited to work in the system as a high-efficiency means of moving high volumes of gas. The reciprocating compressor, on the other hand, was still a necessary addition to the system to perform the high ratio of compression of the gas, a task that the centrifugal compressors was not designed to do. Once the usefulness and performance characteristics of the centrifugal compressor were known, the conversion of the WEP pumping stations to pump gas was a relatively straightforward task. The WEP oil pumps were removed and stored in a heated warehouse in the event that the pipeline might be needed to transport crude oil and its products again in the event of war. The centrifugal compressors, initially built by Ingersoll-Rand and later by Clark and DeLaval, were then installed in place of the pumps and were bolted to the existing flanges and motor driveshafts. The centrifugal gas compressors were designed to be driven by 1,250-horsepower, 3,600-rpm electric motors which were used on the WEP products pipeline. The slower, 1,800-rpm crude oil motors were replaced with the faster products motors which were removed from stations where centrifugal compressors were not being installed (Reed 1948:131).

At several locations, the wood-frame pump house buildings were torn down and replaced with steel buildings with brick fire walls separating the compressor and motor rooms. An explosion-proof telephone system directly connecting the stations was installed in the motor and control rooms. The specially designed high-pressure oil-seal systems for the compressor shafts were set on auxiliary foundations at the front of each compressor unit and connected to the compressor shaft seals. The oil-seal and lubrication system required a filter system, coolers, an emergency generator, and a backup pressure reservoir. Should power fail, the emergency generator would provide power for the system's pump to maintain seal pressure. In the event of a backup generator failure or a pump failure, an air pressure reservoir would maintain pressure long enough for the station pipeline valves to be manually closed, isolating the compressors from the mainline. The cooling system, called "fin coolers," was equipped with two large air-circulating fans and was located midway between the 24-inch-diameter and the 20-inch-diameter pipeline pump houses to serve both systems (Reed 1948:130).

The WEP-installed, manually operated, cast-iron valves were replaced by air-operated steel valves in most locations, including headers, station suction, discharge lines, and inside the pump houses. The cast-iron valves were not as strong as the steel valves, and in several instances the bonnet or top housing had ruptured. The original Seymour Station was completely destroyed, in 1948, by explosion and fire as the result of a failed valve. Crucial valves at the stations and along the pipelines were interconnected with a single-control, pneumatic-operated emergency shutdown system (*Pipe Line News* 1951:4).

A notable feature of the original WEP pipelines was the scraper boxes, which allowed cleaning or "scraping" of the lines by a scraper or "pig" forced through the line by the pressure of the petroleum product behind it. The pig was inserted into the line at one station and pushed water, sludge, and other debris ahead of it to be

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removed at the next station. Early in the process of conversion to gas, TETCO employed the scraper system to increase dramatically the efficiency of the pipelines. The advantages of frequent cleaning prompted TETCO to improve the design of the traps, moving them aboveground, adding better valves and gaskets, and equipping them with booms for the handling of the pigs. Scrubber units which removed foreign material from the gas were also installed in the pipelines before they entered the pump houses to protect the pumps from minute but damaging particles (*Pipe Line News* 1951:9).

By April 1948, seven centrifugal-compressor and three reciprocating-compressor stations were up and running and delivering 340 million cubic feet of gas a day. Ten stations of the 21 planned were now providing three-fourths of the goal capacity. Demand, however, was increasing more rapidly than expected, and a new target delivery capacity of 508 million cubic feet was announced. The "508" program, as it was called, shifted the balance of the stations to seven reciprocating- and 14 centrifugal-compressor stations.

By the time the 508 program was completed in January 1949, the postwar economic expansion was driving heavy industrial gas consumption to unprecedented heights. Another gas transmission company, the Texas Gas Transmission Company, was building a 26-inch-diameter gas pipeline from Texas to Ohio, predicated on the ability to tie into TETCO's pipeline at Lebanon, Ohio, for delivery to points east. TETCO applied for and was granted approval for its third major expansion to extend capacity to 740 million cubic feet daily. This third expansion commenced in the spring of 1949 and was completed in early 1950. The project included a 109-mile extension of the Little Big Inch Line to reach new gas sources in Texas, construction of over 227 miles of 20-inch- and 26-inch-diameter pipeline "loops," and the installation of 32,750 additional horsepower at eight compressor stations (*Pipe Line News* 1951:5; TETCO 1954:10).

While the third expansion was underway, TETCO developed a plan to reach and serve the New England market. TETCO contracted with a newly formed company, the Algonquin Gas Transmission Company, to supply its gas requirements if it built a pipeline to New England. With contract in hand, Algonquin was able to finance the construction of a 26-inch-diameter pipeline from TETCO's Lambertville, New Jersey, station to various gas utilities in New England. To meet the huge demand that would be created by entering the New England market, TETCO decided to build an entirely new pipeline, 30 inches in diameter and 791 miles long, between Kosciusko, Mississippi, and their Connellsville, Pennsylvania, station. The new pipeline would require the construction of five additional compressor stations, totaling 98,900 installed horsepower. Approval for the new line was granted in February 1951, and construction followed immediately. The so-called Kosciusko Pipeline was completed in 1952, increasing TETCO's delivery capacity to 1.2 billion cubic feet per day (Ewing 1989:36-37; TETCO 1954:10).

Two additional projects undertaken by TETCO during its early growth years were the development of underground gas storage facilities and the connection with new gas sources in Southwest Texas. The 105-billion-cubic-foot capacity underground gas storage facility, located in depleted gas sands covering 19,000 acres near Pittsburgh, Pennsylvania, was developed in partnership with the New York State Natural Gas Company between 1950 and 1953. The new gas supplies, located in the Wilcox Trend gas formation, were provided by a new subsidiary company called the Wilcox Trend Gathering System, Inc. To access the new source, TETCO built 305 miles of 24-inch-diameter pipeline between Provident City, Texas, and Castor, Louisiana, which was completed and put into service in 1953 (TETCO 1954:11).

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By the end of 1953, just six years from the start of its operation in 1947, TETCO had expanded its capacity nearly tenfold, from 138 million to over 1.2 billion cubic feet per day. Its total pipeline mileage increased by 1,318 miles to over 4,500 miles and was operating with one of the highest efficiencies in the industry (TETCO 1954:11).

Over the course of operations, the Little Big Inch Line proved unsatisfactory as a transporter of natural gas, and in 1957 TETCO converted it back to a common-carrier products pipeline. At 20 inches, the Little Big Inch Line was too small to transport natural gas economically, particularly now that the industry was increasingly transmitting gas through 30-inch-diameter pipe. In addition, the Little Big Inch Line had been plagued by defective pipe problems from the beginning. Youngstown Sheet & Tube Company, the Little Big Inch Line's pipe supplier, was forced to refund millions of dollars because the pipe was not up to specifications. The higher pressure used to operate the pipelines for natural gas caused ruptures. Eventually TETCO performed hydrostatic tests along the length of the pipeline and blew out the weak portions to replace them (Hargrove 1988a:24, 1988b:11).

Barge operators, not wishing to compete against a products pipeline, strongly objected to the Little Big Inch Line reconversion. After TETCO received permission from the FPC to convert the pipeline, the barge operators brought a lawsuit, which was eventually settled. Opposition to the plan was also registered by the coal industry, which tried, unsuccessfully, to forestall any competition, and by eastern railroads, which depended on freighting coal (Hargrove 1988b:12-13).

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Reconstruction Finance Corporation, Defense Plant Corporation, Engineers' Reports and Appendices, Plancors 1224-1226:

Folder: Final Engineering Report, Plancor 1226, War Emergency Pipelines, Inc. (Blue Prints and Plot Plans Only): Blueprints of Plots and Plans for Construction. Prepared by Charles P. Cathers, Supervising Engineer.

Description: Blue lines drawn 1942-43, approximately 18x14 inches in size. Include topography. Drawings include construction sections of pipeline; its outline; New York area distribution system; Longview, Texas, feeder system; plot plans of stations; elevations, foundation, and floor plan of operator's residence at pump stations; detail of pump house for water wells; plans and details of

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typical fire apparatus and sample house; garage and warehouse building plan for intermediate stations (handwritten note- "typical at no. 2, 3, 4, 6, 7, 8, 9a, 9b, & 10"); garage and warehouse plans and details, stations nos. 12-23 inc. and no. 26 (handwritten note- "typical at nos. 12-21 & 23"); foundation plan and detail, pump station building, station nos. 16, 22, 23, 24 and 26 (handwritten note- "typical sta. 16, 22, 23, 24 & 26"); plans and details, 4-unit pump station, station nos. 16, 22, 23, 24 and 26 (handwritten note- "typical sta. 16, 22, 23, 24 & 26"); main line pumping station, manifold piping, plan and details, stations nos. 16, 22, 23 and 24; main line pumping station, manifold piping, plan and details, station no. 26, emergency A and B; foundation plan and details for footing and forms, 3-unit pump station; mainline pumping station, manifold piping, plan and details; main pumping station, pump, motor, and bldg. foundations, plan and details; mainline pumping station, manifold piping, plan and details, stations 12, 13, 14, 15, 17, 18, 19, and 20; pump stations, plan and details for 3-unit pump station (handwritten note- "typical sta. 12, 13, 14, 15, 17, 18, 19 & 20"); garage building, building plan, pump station, Longview, Texas; office and warehouse, Station No. 1, Longview; piping layout, Longview Station; Office Building, Longview; office building, Station No. 5 (North Little Rock); garage and warehouse, plans and details, Station No. 5; building plans, Station 9A (Scott County, Missouri); special pipe layout, pump station no. 9A; Norris City Station, piping layout; Division Office Building, Pump Station, Norris City, Illinois; Garage and Warehouse, Norris City; Building Plan, Pump House, Norris City; Philadelphia area delivery system; Main Line Pumping Station, Manifold Piping, Plan and Details, Station No. 21; Pump Station Building, Plans and Details, Pump Station No. 21; Foundation Plans, Pumps, Motor, and Walls, Station No. 21; 1st- and 2nd-Floor Plan, Existing Residence, Connellsville, Pennsylvania; Tank Farm, General Layout Station 25, Phoenixville, Pennsylvania; Garage and Warehouse, Plan and Details, Phoenixville, Pennsylvania; Building Plans, Phoenixville Terminal, Pump Station No. 25; Plans and Details, Pump House Foundations, Phoenixville, Pennsylvania, Station No. 25; Building Plans, Phoenixville Terminal, Pump Station No. 25; Plans, Elevations, and Details, Phoenixville Terminal Pump Station; Phoenixville Station Manifold Piping; Elevations and Exterior Details for Office Building, Linden, New Jersey; Floor and Roof Plans, Linden Office Building; Revised Pump Station Piping at Manifold for New Pumps, Linden Station; The International Derrick and Equipment Company, International-Stacey Corporation, Columbus, Ohio, Beaumont, Texas, Torrance, California (IDECO)-Proposed Sectional Steel Building, 36'-60'-12' (Nominal) for WEP, Inc., IDECO STD. BLDG.- Pump House Drawn 7/23/42; revised 8/17/42 and 8/19/42; Framing Location Plan for IDECO Building.

Engineering drawings located at Texas Eastern Transmission Corporation, 5400 Westheimer Court, Houston, Texas 77251-1642:

Description: TETCO Engineering Records section contains hundreds of drawings and plans for the Big Inch stations. For each station, there is a set of drawings in ink on linen generated in 1944-45 by WEP's Engineering Department in Cincinnati. Since these drawings postdate the construction of the line, they are not "original design" drawings, but rather appear to be documenting conditions as of that time. Some of the drawings for nearly all of the stations have been revised through time, most frequently the facility layout sheets. As a result, many of the layout sheets no longer provide a fully accurate depiction of the stations prior to the acquisition of the pipeline by TETCO. WEP

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drawings for Station Nos. 14 and 15 are most likely to have escaped annotation and revision, as the original World War II facilities were destroyed by fire in 1948 and 1949, respectively. In addition: WEP plot plans of Stations A through E, and 1, 11, 20 through 27, for the period 1944-1946; 1943 plans of Construction Sections of the WEP.

B. Historic Views:

Still Pictures Branch of the National Archives, Archives II, College Park, Maryland.

RG 208-Office of War Information-Finding Aids
FOLDER: 208-PRA — Oversized and mounted prints, photographs used in publications, circa 1942-46
Box 3, Folder 14: Petroleum
All labeled prints indicate project of Tennessee Gas and Transmission Company.

Unnumbered Print: Surveyors in area with Spanish moss hanging from the trees.

Print No. 7012-2: Unidentified pipeline being built across water (By-Line Features from International News Photos, a unit of King Features Synd., Inc., New York, NY).

Print No. 7128-20: Pipeline beside trench being tested for holes with small machine pushed along upper side. Pipeline appears to have been wrapped (By-Line Features).

Print No. 7126-29: Human swab cleaning out pipe. Mule-drawn equipment in background.

Print No. 7126-44: Machine wrapping pipeline. Unidentified project.

Print No. 7128-3: Felt-wrapped pipe being lowered into trench by side-boom tractors in Texas by Tennessee Gas and Transmission Co.

Print No. 7012-3: River clamp suspended by side-boom tractor before it is attached to keep pipe from floating up at a river crossing. Tennessee Gas & Transmission Co.

FOLDER: 208-LU—Photographs Depicting *Life in the United States*, 1942-1946.
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