The years from 1937 to 1949 seem truly deserving of the dramatic descriptions often found in historical accounts of the period. Still mired in the Great Depression, America in 1937 faced a strong recession and a crisis in the New Deal. A mere twelve years later, the country had emerged from the trials of a global war and its aftermath a relatively unified, powerful, and confident nation. Uncertainty about the American way of life that lingered throughout the depression gave way to uncritical declarations of pride in the productive capacity of the economy, the strength of the armed forces, and the sanctity of American ideals. Dreams of an American century of world leadership replaced the despair of economic collapse, and hopes for lasting peace and prosperity pervaded the national consciousness.

The events of this era brought significant changes to Eagle-Picher as well. Propelled by a variety of factors including the depression, the decline of the Tri-State, the Second World War, and the demands of the postwar economy, Eagle-Picher pursued a new direction. In an attempt to avoid following the Tri-State into oblivion, management initiated a reorientation of the company’s business during the 1940s away from mining and toward the expansion and acquisition of manufacturing operations.

The shift seemed only logical given the inevitable decline of the Tri-State, yet implementing change in the midst of extraordinary
times demanded careful planning and astute management. The decision to pursue manufacturing enabled the company to report by 1949 that approximately three-fifths of revenues came from manufacturing ventures. Although Eagle-Picher could claim success with the new focus, a variety of problems remained, remnants of a mining-manufacturing ambivalence present in the company since the merger but heightened to dramatic proportions as Tri-State operations became less profitable.

The need to develop manufacturing often clashed with the need to operate mining and smelting facilities at capacity during the war years. Mining-oriented executives like George Potter believed that the company was abandoning the mining end of the business prematurely. Yet observers within and outside the company realized that, despite the temptations to expand mining operations, Eagle-Picher had to find stable, high margin manufacturing opportunities to ensure long-term growth and reduce the detrimental effects of mining industry cycles. These strategic changes would ultimately lead Potter to resign his position in an act that signaled the beginning of the end of the mining-manufacturing ambivalence.

The company began this important era with a minor management crisis. Bendelari, president of the company since 1928, became ill in early 1937 and by June decided to resign his office. With no apparent successor, the board faced the problem of finding a suitable candidate, preferably from within the company. Opinion among the board was divided between two camps. Several members favored Joseph Hummel, Jr., who held the office of secretary-treasurer, for the presidency. Others believed that Hummel did not possess sufficient management experience and argued for the election of an outsider, preferably Joel M. Bowlby. A compromise resulted in the election of Hummel as president and William R. Dice as executive vice-president on 29 June. According to the plan the two men would divide the responsibilities of the presidency and rely on Bowlby, retained by the board as a consultant, for advice when the need arose.¹

**Acquisition of Commerce Mining and Royalty**

With top management stabilized, the company faced its most pressing concern—diminishing ore reserves in the Tri-State. The Mining
and Smelting Company had pursued an ongoing exploration program for new reserves in an effort to lessen dependence on near depleted mines. Simultaneously, it had continued research into metallurgical techniques to recover greater concentrations of ores. Although the Picher field remained profitable, declining production and lower recovery statistics forced management to seek additional opportunities. As head of mining operations, the responsibility fell to George Potter. As he surveyed various possibilities, Potter became convinced that Eagle-Picher should again attempt to acquire the extensive properties of the Commerce Mining and Royalty Company.

As part of the company’s ongoing goal to remain the leading Tri-State producer, the move to acquire the property had begun in 1932. In September of that year the board organized a contact committee consisting of members C. L. Harrison, A. Kiefer Mayer, and Vincent H. Beckman to investigate “the desirability of the Eagle-Picher Lead Company acquiring the Commerce Mining and Royalty Company.” The committee’s interest in Commerce fit logically into the sequence of events that included the incorporation of the Mining and Smelting Company, the construction of the Central Mill, and the acquisition of various small ore-producing properties. Management had realized the necessity of securing substantial ore reserves to ensure the long-term profitability and efficiency of Tri-State operations, especially the Central Mill. Facing the pressures of the depression and steadily declining reserves, Potter reasoned that acquiring Commerce would ensure the mill’s long-term success and secure Eagle-Picher’s position as the leading company in the Tri-State. In addition to extensive ore reserves, Commerce possessed a number of mills, a large power plant, and the Northeast Oklahoma Railroad Company (NEO).

Problems arose during the final phase of negotiations for the merger. A family business, Commerce mined only enough ore at a time to satisfy its immediate financial needs. Despite persuasion from Potter, the owners of Commerce opposed the merger since they remained unwilling to pay steep taxes on the sale of the mines and other properties.

The independent nature of the Commerce organization resulted from a history of successful mining ventures. In 1905, four men, James F. Robinson, George L. Coleman, Sr., his brother A. L. Coleman, and C. M. Harvey, Sr., formed a partnership to prospect for
ore in northeast Oklahoma. Robinson and Harvey managed a real estate and insurance business in Miami that specialized in agricultural leases. The Coleman brothers earned a modest living drilling wells and occasionally prospecting for ore in Ottawa County, north of Miami. After a series of failures, the partnership made its first ore strike in late 1905 while drilling a water well for a farmer approximately four miles north of Miami. Soon after, they obtained leases on nearby properties and increased their drilling efforts.

Before long, the exploration paid off and resulted in the organization of a new firm. The success of prospecting operations on the new lands gave rise to a small mining camp known as Hattonville (now Commerce), named after a local mill operator who had laid out the site. Robinson and Harvey’s expertise in securing leases and the Coleman brothers’ active exploration of additional ore-laden sites enabled the partnership to acquire many valuable holdings before its good fortune became widely known. Soon large profits from their operations forced the partners to organize themselves more efficiently. When originally formed, none of the men expected the partnership to amount to anything. Consequently, they had paid little attention to details and contingencies that were to have significant financial impact as a result of their success. In 1906, the partnership became the Miami Royalty Company. However, organizational and legal problems persisted. In 1913, the group chartered a business trust called the Commerce Mining and Royalty Company.

Consistently expanding mining operations throughout the 1920s returned handsome profits for Commerce. In 1927, the company completed the Goose Mill near Cardin, one of the first all-steel constructed mills in the district. During the same year the company also completed a $1 million power plant west of Cardin that furnished electricity and compressed air to company mines, mills, and the NEO railroad. However, the construction of the Bird Dog Mill proved to be Commerce’s most significant achievement. Completed in June 1930, the Bird Dog, the first central mill in the Tri-State, proved the feasibility and profitability of central milling. The brainchild of Elmer Isern, a Commerce mining engineer, the mill served as an invaluable model for George Potter and associates during the planning and construction of Eagle-Picher’s Central Mill.

Although the Great Depression and the resulting chaos in metal markets occasioned losses for Commerce during the 1930s, the com-
pany remained a viable enterprise second only to Eagle-Picher in zinc and lead production. Still tightly controlled by the trustees, Commerce remained reluctant to sell to Eagle-Picher and incur steep taxes in the midst of the depression, and it rebuffed the acquisition for a time. Finally, late in 1938 Eagle-Picher again opened communications with Commerce in an attempt to negotiate a merger agreement. Eagle-Picher formed a committee consisting of Potter, Dice, Geist, and Bowlby to meet with Commerce in December to arrange "the acquisition of the Commerce Mining and Royalty Company particularly as to the tax problems and financing angles involved therein." The key man was Bowlby. In his role as general consultant to Eagle-Picher, he fashioned a plan enabling Commerce to sell profitably. Bowlby also arranged the financing for Eagle-Picher. Impressed with the plan, Commerce officials agreed to finalize the merger.  

With formal approval given by both the Eagle-Picher board and Commerce officials, the final phase of the merger occurred during the last week of December 1938. Several board members made a thorough inspection of all Commerce properties, and the two companies consummated the merger at the Commerce offices in Miami on 28 December. Eagle-Picher paid approximately $10 million for Commerce, the largest transaction of its kind in Tri-State history. Eagle-Picher officials also announced that there would be no substantial changes in the management or organization of the newly acquired interest. The Mining and Smelting Company integrated Commerce personnel and property into its organizational scheme, which functioned essentially, though not formally, as a division of Eagle-Picher.  

The policy applied to Commerce established a long lasting tradition. In later years when Eagle-Picher acquired other firms, it insisted and often demanded as a condition of purchase that the management of an acquired company remain intact to ensure the continued success of the business. Moreover, the Commerce purchase proved extremely beneficial to Eagle-Picher. The merger represented the culmination of plans formulated in the late 1920s to guide the company from a position of declining profitability to a position of undisputed leadership in the Tri-State. As a result, Eagle-Picher became the largest producer of zinc ore in the nation. Additionally, the successful acquisition of Commerce provided an experience that the
firm's management would draw upon during the 1940s, when it shifted resources from mining to manufacturing.

**Preparation and Conduct of War Production**

Acquiring the Commerce Mining and Royalty Company did not fundamentally reshape the business prospects of Eagle-Picher. The overall financial health of the company remained closely tied to the cycle of the zinc market, and to a lesser extent the lead market. Although the Commerce purchase extended the life of company mining operations, it did not offer any relief from market uncertainties. Eagle-Picher remained ambivalent about the need to redirect its business. During the 1930s, primarily as a result of the depression, the company had focused its major efforts on year-to-year problems and continued to drift with the times. A lethargy among management had set in, and long-range planning suffered from a preoccupation with the effects of unstable metal prices. Although Eagle-Picher adopted a valuable system of organization, it remained unprepared to utilize the divisional system as a framework for expansion into new, higher margin areas of manufacturing. As a result, top management remained content with the mining orientation, especially after the fruits of the Commerce purchase became apparent.

In 1939 sales increased 51 percent over 1938 results to almost $26 million, and net profit approached $1.2 million, a remarkable improvement over the previous year, when the company had recorded a net loss of nearly $500,000. Indeed Hummel was a lucky man. Although he could not have foreseen the German invasion of Poland on 1 September, increased demand for zinc and lead products for national defense resulted in the largest production of zinc and lead concentrates in the history of the company. Clearly these events did not indicate to corporate management, especially those in the Mining and Smelting Company, that Eagle-Picher needed a change in direction. In fact, the course of world events made the outlook for the mining and smelting business extremely promising.

The coming of war in Europe and the prevailing uncertainties heightened the demand for defense-related raw materials. As Americans watched the seemingly invincible flow of Nazi aggression in
Europe and the deterioration of relations with Japan in the Far East, an awakening concern for national defense swept the country. Consequently, orders for strategic materials increased dramatically. Demand for zinc during 1940 exceeded the nation’s productive capacity. Hummel reported that the company, "as one of the largest zinc producers, has increased its mining and milling production and smelter capacity to assist in meeting the demand."11 For a short time, at least, the firm’s prospects seemed bright. Profits for 1940 reached $1.3 million, sales increased to nearly $28 million, and per share earnings rose from $1.30 in 1939 to $1.44 in 1940. Increased profits resulted almost entirely from the demand for lead and zinc. Sales of manufactured items, while showing "a satisfactory increase," represented a considerably smaller percentage of earnings growth.12

With mounting demand for zinc, the company increased its exploration program for ore reserves. In the fall of 1941, a Mexican geological engineering company, Vaupell and Garcia, called Eagle-Picher's attention to zinc ore deposits near Taxco, Mexico. Vaupell and Garcia’s report seemed very promising to Potter, who arranged to lease the properties. When initial exploration confirmed the existence of substantial ore reserves, the company purchased the properties and began construction of a mill.13

A pivotal year for the nation, 1941 was also a crucial year in the history of Eagle-Picher. The war put an indelible stamp of change on the company. Events associated with the war pushed Eagle-Picher toward a shift of its resources into manufacturing. The Japanese attack on Pearl Harbor assured American participation in the Second World War, and the war in turn became a catalyst for change within the company. As a producer of vital war materials, Eagle-Picher became a leading supplier of zinc, lead, battery oxides, paint and paint pigments, insulation, and a number of additional products.14 The research department also developed military battery systems, and participated in government semiconductor research by perfecting a process for the recovery and purification of the rare element germanium from Tri-State ores.

The demands of conducting business in a war economy made decisive leadership a necessity. The company engaged a consulting firm, Robert Heller and Associates of Cleveland, to assess the overall status of the company and recommend changes in policy and management.
Heller's report, submitted to the board in June 1941, recommended that Eagle-Picher pursue expansion in manufacturing through acquisitions and by the extension of current processes. The report also recommended that the board elect Joel M. Bowlby to the presidency of Eagle-Picher, citing his extensive financial expertise and considerable knowledge of company operations gained from his year as a consultant. On 27 June the board elected Bowlby to the presidency. Hummel remained as chairman of the board.15

Born in 1887 in Litchfield, Illinois, Joel Morgan Bowlby received his B.S. degree from Southern Illinois University in 1904. Upon graduation he began his business career in the Litchfield office of the Railway Steel-Spring Company. In 1909 Bowlby joined a local banking and investment firm and, after obtaining his CPA, worked as a certified public accountant until 1916. When America entered World War I, Bowlby enlisted in the U.S. Army and attained the rank of major in the infantry by the time of his discharge in 1919. Before returning to private industry, he served with the U.S. Liquidation Commission, a division of the War Department that functioned as the central sales agent and accounting office for the disposal of surplus war material in Europe. In 1921, Bowlby joined the Chicago accounting firm Barrow, Wade, Guthrie and Company and developed expertise in tax accounting. Elected a general partner of the firm in 1928, he began his association with Eagle-Picher as a consultant in 1936.16

Bowlby brought a tradition of public service to the company during his tenure as president. His community activities included work for the Cincinnati Community Development Committee, the Navy League of Cincinnati, the General Protestant Orphan Home, and the Community Chest.17 Described by the Cincinnati Enquirer as "one of the hard working, public spirited men whose devotion to the general welfare of the city makes it a great city," Bowlby attracted much favorable attention to the company as a result of his public activities.18

Described by Fortune as "a charmingly vain midwestern sophisticate," Bowlby possessed talents that Eagle-Picher desperately needed.19 As chief executive, he brought a fresh perspective to top management. The first outsider to hold the office, he combined a strong financial background with a detailed, though bookish knowledge, of the company. As an outsider, Bowlby held a more objective
view of problems that divided top management. His status enabled him to fend off challenges and redirect the business toward manufacturing.

Of course, the transformation could not be accomplished overnight, especially during wartime, when mineral products were in great demand. Nor would the company desire to shift too rapidly, for the demands of a war economy placed pressure on the Tri-State mines to produce at capacity and in turn created nice profits. Instead, according to Bowlby’s plans, profits gained from the mining boom during the war would be used to finance expansion into manufacturing. Bowlby intended to remain active in mining, but only as a source of raw materials for the company’s manufacturing processes. By eliminating the mining-manufacturing ambivalence, he hoped to initiate a new era of stability and growth for Eagle-Picher.

Bowlby’s plan seemed simple enough in its general thrust: to place the company in a stronger financial position, to improve and expand production methods and facilities, and to adopt a program of manufacturing expansion and product diversification. Even in a normal economy, these goals presented major challenges to the company. The rigors of a wartime economy, however, created additional complications and dilemmas that often impeded progress toward corporate goals. Yet the challenges of the war years proved beneficial to Eagle-Picher. With specific objectives and strong leadership the company ceased to drift. A sense of purpose, missing since the death of Oliver S. Picher, began to spread through the organization.

After the declaration of war against Germany and Japan on 8 December 1941, the United States embarked on a crusade that touched nearly every segment of American society. The challenge of a two-front war and the logistical difficulties of conducting such a war propelled the federal government to implement far-reaching economic and social controls. The task of awakening depression-weary American industry and organizing an efficient war economy demanded that the government and private industry work together on a scale never before conceived.

A multitude of administrative structures, most important the War Production Board, enabled the close cooperation necessary to provide the armed forces with essential materials for the conduct of the war. The sacrifices necessary to achieve victory placed heavy demands on American industry. Price controls, increased taxation, profit ceil-
ings, production quotas, and product conversion represented only a few of the measures implemented by the government to mobilize industry for war.\textsuperscript{20}

In the months after Pearl Harbor, with the Allied effort at its nadir, American industrial leaders began to assess the role of their particular businesses in the overall plan of mobilization. Many began the process of conversion to the manufacture of products essential for the war effort. Others, whose businesses did not require conversion, spent long hours in an effort to maximize efficiency and production. All, however, remained acutely aware of the need for careful planning and administration of industrial production.

Although Eagle-Picher was prepared to make the necessary wartime sacrifices, the nature of its products made conversion unnecessary. Most of the company’s major products such as slab zinc, paint pigments, lead and zinc oxides, and metallic products such as bearing metals, antimonial leads, and solders fell in the category of strategic war materials. The company’s insulation products also served the need for fuel conservation in home and industry. Nevertheless, with government price controls and increased manufacturing costs, the company realized little profit on many of these items.

The strength of mining operations during the war enabled Eagle-Picher to increase earnings despite slim margins on manufactured goods. Government subsidies in the form of control over strategic metal markets to stimulate production resulted in high, stable prices for lead and zinc. The Federal Price Administration set zinc prices at 8.66 cents per pound and lead at 6.48 cents per pound in January 1942. Nearly twice depression-era averages, these prices propelled production to keep up with war demand and produced stable mining profits for the company. The federal government offered another incentive, called the Premium Price Plan, to increase production of zinc by paying bonuses for production over the quotas established by the Metals Reserve Company, an agency subsidiary to the Reconstruction Finance Corporation.\textsuperscript{21} As a result of government stimuli and increased demand, Eagle-Picher expanded mining and smelting operations “to the fullest practicable extent.”\textsuperscript{22}

Eagle-Picher derived a majority of its income during the war years from mining operations thanks to government price supports. As a result the Tri-State remained critically important to the health of the company despite management’s realization that it could not base the
company's future on zinc and lead mining. Two related issues, labor supply and the improvement of mining technology, received considerable attention during World War II from the company and the federal government.

The war brought a boomtown atmosphere back to the Tri-State, if only for a brief time. The district accounted for over one-third of zinc production and one-tenth of lead production in the nation during the war years, an output reminiscent of the late-1920s. The strategic importance of lead and zinc, however, challenged the federal government and district mining companies to increase production from near depleted mines and regulate the ever present wartime labor shortages.

Operating the mines at capacity with a reduced labor force proved difficult. Although the demands of the Selective Service Act and the competition from other defense industries affected the entire economy, mining operations suffered the most. Even though the government released some miners from military service to work in the mines, shortages persisted and turnover remained high. As of March 1943 more than 35 percent of full-time employees had been with Eagle-Picher for less than one year. To combat problems of inexperience, the Mining and Smelting Company initiated a program of close supervision and intensive training of new employees. The training program provided many benefits, including improved production efficiency and the reduction of mine accidents from prewar levels.

Yet even a full labor force could not have solved the key problem of meeting production schedules with low-grade ore reserves. The company achieved production goals by a variety of methods. The demands of war and ensuing price subsidies provided incentives for mining engineers to recover lead and zinc from marginal ore bodies by improving metallurgical processes, increasing mine mechanization, and expanding capacity at the Central Mill.

Mine mechanization proved especially effective. Although limited mechanization had appeared during the 1930s, extensive mechanization evolved during the war years. The company adapted diesel technology to Tri-State mining operations by designing a process to introduce oxygen through the exhaust system of vehicles to eliminate carbon monoxide pollution. The most successful diesel vehicle was the "caterpillar jumbo," a mobile platform with tank treads and tele-
scoping booms that could perform various types of excavations. Extensive use of the jumbo resulted in an increase of production from twelve to forty-two rock tons per man shift within several years. Another significant innovation in mechanized mining was the battery-powered dump truck known as the "blitz buggy." A small, four-wheel vehicle, it eventually replaced the mule and rail car as the main form of underground ore transportation. Power for the blitz buggy came from two large Eagle-Picher batteries capable of storing enough energy to complete an eight-hour shift without recharging. The development of mechanized transportation led to "trackless mining" and to the construction of over one hundred miles of underground highways connecting mines in the Picher field. Mechanized mining became the most important component of the company's efforts to meet the demands of war production by prolonging the productive life of the Tri-State.26

With improved mining technology and government subsidies the Tri-State remained a productive force during the war in what proved to be the last gasp of a great mining region. Statistics showed that whereas the district had produced 55 percent of the zinc and 15 percent of the lead in the United States in 1927, by 1946 it produced 25 percent of the nation's zinc and a mere 7 percent of the lead. Furthermore, the average recovery of combined zinc and lead concentrates fell from approximately 6.14 percent in 1927 to 3.07 percent by the end of the war.27

Seeking to relieve the company from questionable investments in the mines, Bowlby used the decline of the Tri-State to the company's advantage when, in 1942, he accelerated the amortization of Eagle-Picher's investment in the district. From 1942 to 1944, depletion and depreciation charges totaled approximately $8.7 million, compared with the 1939-41 total of approximately $4.3 million. As a result, Bowlby reduced the net fixed assets of the company and wrote down the Tri-State mining properties below their salvage value. By setting aside a substantial part of wartime profits for accelerated amortization of these properties, Bowlby freed the company from a dubious future investment and converted fixed assets into cash needed for the transition to manufacturing.28

However, these moves convinced George Potter that there would be no place for him in the postwar company, and he resigned in 1944 after a stormy session with several board members. The "Cincinnati
crowd," referring to Bowlby and the board, simply did not appreciate all that the Tri-State had given the company, and Potter genuinely believed that Eagle-Picher was heading in the wrong direction. The once powerful Potter had witnessed his influence over corporate direction decline along with the Tri-State, and he retired to his own mining interests with bitter feelings toward the company.29

Although Bowlby recognized that the company needed to become less dependent on mining operations as its major source of income, the war effort nevertheless demanded consistent increases in Tri-State production. With Tri-State resources strained, the Mining and Smelting Company negotiated an option to purchase a mine twenty miles south of Tucson, Arizona. Eagle-Picher constructed a small mill, called the Sahuarita after the nearest town, and mining and milling operations began in early 1943. The company also increased production at the Taxco mines in Mexico to offset demand on the Tri-State.30

Company literature during the war proclaimed Eagle-Picher's service to the Allied cause. A pamphlet entitled "Out of the Earth to Serve the Nation" provided an overview of the company's contributions to war production. For example, battery oxides performed essential functions in airplanes, submarines, signal devices, and automotive equipment. Zinc products aided the manufacture of ammunition shells, cartridges, fuses, and casings. Eagle-Picher also sold large quantities of zinc for galvanizing. Antimonial lead used in bullets, lead base bearings used in all types of vehicles, and optical lead used in cameras, binoculars, and lenses served important functions during the war.31

Paint pigments, especially those with rust inhibitive properties such as sublimed blue lead, proved extremely popular with the shipbuilding industry. Eagle White Lead was used as a protective coating for cantonments, war plants, and military structures of various types. Finally, insulation products such as mineral wool batts, blankets, and pipe coverings served a variety of industrial needs in the effort to conserve energy.32

At Eagle-Picher, participation in the war manifested itself in ways other than the production of war-related commodities. Nearly one thousand employees served in the armed forces. Others participated in a voluntary, company-sponsored war bond purchase plan. Pre-dating the establishment of the government's payroll allotment plan
for war bond purchase, the company's plan received praise from the Treasury Department and from other firms that adopted similar programs. Top management proudly stated that cooperation with government-sponsored bond plans entitled "nearly all" plants and mines to fly the Minute Man flag symbolic of active participation.\textsuperscript{33}

**Labor Relations during the 1940s**

The tumultuous labor struggles in the Tri-State during the 1930s provided a rude awakening for Eagle-Picher. The company had never faced any serious difficulties with its workers, and corporate officials were slow to accept the revolution in management-labor relations brought about by New Deal reforms. The company remained reluctant to yield to union power, and the leftist and Communist leanings within the International Union of Mine, Mill, and Smelter Workers, CIO, caused great consternation and solidified antiunion attitudes. As labor historian George Suggs has observed, the attitudes of district companies "did not soften" despite the union's new found rights. The International was still "an outlaw union," and operators remained committed to limiting its power wherever possible.\textsuperscript{34}

Despite a favorable ruling from the NLRB in 1939 that required Eagle-Picher to reinstate employees fired for participating in the 1935 strike, the union failed to expand its power in the Tri-State during the 1940s. Several factors contributed to its lack of success. Industry workers remained wary of the union movement, even after the NLRB victory. Further, Eagle-Picher, through its numerous mining acquisitions during the 1930s, brought more workers under its control and wielded greater power against union organizers. The most important factor, however, was the economic decline of the Tri-State, which accelerated rapidly after World War II.\textsuperscript{35}

Even during the boom years of the war, union membership in the Tri-State remained well below membership levels in other nonferrous mining regions, especially in the West.\textsuperscript{36} After the war, with ore deposits virtually exhausted, the district economy deteriorated and undercut any momentum the union might have gained. In addition, the lead and zinc policies of the federal government, which included low import tariffs, heavy buying of foreign lead and zinc for strategic stockpiling, and a refusal to subsidize Tri-State production, cast a
dismal future for district companies and their unions.\textsuperscript{37} Coupled with the internecine ideological struggles in the International Union and continuing opposition from industry, the union movement in the Tri-State faced insurmountable obstacles.\textsuperscript{38}

Eagle-Picher experienced its first postwar labor problem at the Henryetta smelter. When negotiations for a new contract broke down in April 1946, six hundred employees represented by the International Union voted for a strike. The union demanded an 18.5 cent per hour wage increase, a forty-hour week, alteration of seniority procedures, and a number of other concessions. Eagle-Picher countered with an offer to increase wages 15 cents per hour on a forty-hour week, or a continuation of the present rate for a forty-eight hour week, which was a nonoffer.\textsuperscript{39}

For two months neither side moved from its position. Unlike the 1935 strike in the Tri-State, however, there was no violence, and union members did not even set up picket lines at the plant. On 26 June Eagle-Picher offered 72 cents per day on a forty-eight hour week, and a promise to raise wages an additional 8.5 cents per day when the smelter went on a forty-hour week. The union quickly pointed out that postwar wage increases in other nonferrous industries averaged $1.48 per day, and rejected the offer.\textsuperscript{40}

Despite ongoing negotiations and federal mediation, an agreement could not be reached until mid-August. Of great significance in settling the strike was the decision of the Oklahoma Unemployment Security Commission on 20 August to deny unemployment benefits to the striking workers. Both parties signed an agreement to end the strike on 31 August, when Eagle-Picher offered an 18.5 cent per hour raise. The union membership voted to accept the contract, and the smelter resumed operations on 22 September.\textsuperscript{41} With the strike settled, Eagle-Picher warned employees that unless productivity increased, the plant might have to be closed. Although the wage increase cut margins, the company did not intend to close the plant.

In the Tri-State, the International Union met with less success. In 1946 it organized the Eagle-Picher Mine and Millmen’s Union, Local 861, specifically to represent Eagle-Picher employees. The company tolerated the union for a time, but in May 1948, when negotiations for a new contract began, the company decided to try to break the union. When Local 861 presented a list of 21 demands, the company
paid little attention. As a result, the union called a strike to begin on 30 June.42

Determined to crush the strike, Eagle-Picher agreed to discuss only 9 of the 21 demands. The union’s main demands included an 18.5 cent per hour wage increase, shift differential pay, and vacation pay. These were undoubtedly inspired by the Henryetta contract, although union leaders realized that the company would be far less willing to make concessions when mining operations were losing money and in permanent decline. Eagle-Picher offered a 12.5 cent per hour increase with no other concessions. On 18 November the union accepted the offer, and 650 striking workers returned to their jobs.43

A variety of factors aided the company’s successful confrontation with the union. The issue of Communism in the International Union’s leadership provided a great advantage. Under the provisions of the Taft-Hartley Act of 1947, union leaders had to swear by affidavit that they were not Communists. When several leaders of the International Union refused to do this, the union became an easy target. With the dawn of the cold war to fuel patriotic fervor, many miners were easily persuaded that the union was a tool of the international Communist movement. Furthermore, as in 1935, Eagle-Picher sponsored a back-to-work movement, this time under the auspices of an organization called the Tri-State Mine and Millmen’s Association.44 Walter Cherry, the leader of the association, supported Eagle-Picher and coordinated the recruitment of workers into the organization by company foremen. The association was also very helpful in carrying the anti-Communist message to company employees.45

The International Union, rife with dissent after the strike, also faced the encroachment of the United Cement, Lime, and Gypsum Workers Union, AFL. Even during the strike, local officials of the International Union had contacted the United Union concerning possible affiliation. United organizers actively recruited Local 861 members, dealing the International another serious blow. In June 1949 the NLRB held an election to determine which union would represent Eagle-Picher workers. Under Taft-Hartley the International Union was excluded from the ballot because its leaders had not signed the required non-Communist affidavits. The United Union easily won the election and used it as a foothold to recruit workers in other In-
ternational Union locals throughout the district. The Gas, Coke, and Chemical Workers Union, CIO, was also active in raiding International Union membership.46

These events, however, held far less significance than they might have if the Tri-State had remained an important producer of lead and zinc. With ore reserves exhausted and an unfavorable government policy, by the early 1950s the Tri-State was no longer a major factor. However, for Eagle-Picher, who abandoned mining in the district for more profitable businesses, the experiences of dealing with nonferrous industry unionism were indelibly etched in the corporate memory.

Research Accomplishments

The company proudly cited most of its contributions to the war effort publicly. But its research staff made other significant, classified contributions to the development of technology that benefited not only the immediate needs of the Allies but opened promising postwar markets. Appropriations for research increased dramatically during the war and remained closely tied to Bowlby’s program of expanding and diversifying the company’s manufacturing capabilities.47 Goals for the research department included improving manufacturing processes, extending the usefulness of current products, and developing new products.

Two of the most crucial wartime research projects, specialty battery systems and high-purity germanium, eventually became two of Eagle-Picher’s most important and profitable postwar businesses.48 The development of these high technology products represented a significant departure from the company’s typical high volume, low margin product line. Characteristic of the type of businesses Bowlby desired to promote, they would become standard bearers of excellence for the entire company.

The Joplin battery laboratory’s relationship with the U.S. Army Signal Corps proved especially fruitful. In 1942 the Signal Corps negotiated a contract with Eagle-Picher to increase the efficiency and capability of military batteries. Officials at the Signal Corps were eager to develop special battery oxides that operated efficiently over a wide range of temperatures for use in meteorological radiosonde bat-
teries. The battery laboratory developed oxides that passed crucial tolerance tests, and the army awarded additional production contracts.\(^4^9\) Impressed with the results of the oxide project, in 1944 the Signal Corps chose Eagle-Picher for the development and production of an entire radiosonde battery system. The lightweight magnesium-
cuprous chloride battery developed by the company powered a radio attached to a weather balloon that sent essential data to weather forecasters on Allied air bases.\(^5^0\) Besides the radiosonde project, from 1944 to 1949 the battery laboratory investigated a number of electrochemical systems potentially suited for defense applications with the support of government contracts. Three systems attracted the most attention: silver-zinc, lead-fluoroboric acid, and conventional lead-acid. Of these, the silver-zinc system seemed the most promising since its high power, low mass configuration made it ideal for military applications.\(^5^1\)

The development of guided missile systems in the late 1940s provided an excellent market for the silver-zinc system. Proving reliable and cost efficient, Eagle-Picher batteries became industry standards. The success of the silver-zinc batteries enabled the company to cultivate the growing aerospace and defense markets after the war. Many important contacts with the armed services developed during this period, and Eagle-Picher came to be recognized as a leader in specialized battery technology.\(^5^2\)

In addition to the key accomplishments of the battery laboratory, research department scientists pursued an equally promising field during the early 1940s. Interest centered on the rare element germanium, prized for its properties as a semiconductor and crucial to wartime research in the field of solid-state physics under the National Defense Research Committee (NDRC). Established by President Roosevelt in 1940, the NDRC supported scientific research on the "mechanisms and devices of warfare." In the effort to develop an alternative to the vacuum tube in a variety of sophisticated electronics applications, especially for microwave radar detection, the NDRC funded scientists in the United States and Britain to study a variety of semiconducting materials. Germanium proved the most promising, and the NDRC conducted an extensive search for usable germanium in 1942.\(^5^3\)

Two problems confronted the NDRC. Researchers needed a steady supply of the element and a recovery process that could provide the
high-purity germanium necessary for reliable semiconductor operation. Presuming no such recovery process existed, the NDRC searched for an appropriate place to fund a recovery program. Since traces of germanium were known to exist in the Tri-State, the committee contacted Eagle-Picher as a potential participant. To the NDRC’s surprise Eagle-Picher reported that germanium recovery was an official company research project and that sufficient quantities could be supplied to meet the program’s requirements.54

Consequently, Eagle-Picher became the sole supplier of high-purity germanium in the 1940s and early 1950s. During the Second World War the company provided germanium for use in early radar devices and for other defense-related projects. After the war scientists at Bell Laboratories and Purdue University made tremendous strides in the field of solid-state physics using Eagle-Picher germanium. The invention of the transistor at Bell Laboratories was certainly the most dramatic result of the widespread interest in semiconductor research. By providing high-purity germanium Eagle-Picher played an essential role in the birth of the electronics age.

The most significant research achievement in company history, germanium recovery and production held far-reaching implications for Eagle-Picher and for the emerging electronics industry. The role of germanium in the development of solid-state electronics has often been overlooked. Germanium research enabled the practical application of theoretical advances in solid-state physics and established new standards for high-purity metallurgy. The history of the commercial development of germanium provides insight into an important and often neglected chapter in the development of the electronics industry. Entry into this specialized field brought the company both prestige and tremendous profits. Moreover, Eagle-Picher’s germanium research, along with the stunning achievements at Purdue and Bell Laboratories, laid the foundation for one of the greatest technological achievements in history.

Until the advent of solid-state physics scientists had paid little attention to germanium. Classified as a rare metal and without specific applications, germanium had remained a curiosity for many years after its discovery. The image of germanium as a rare and elusive element had persisted ever since British chemist John A. R. Newlands predicted its existence in 1864. Seven years later, Russian scientist D. I. Mendeleev, noting several obvious gaps in his newly formulated
periodic table of elements, predicted the existence of a new element that he called "eka-silicon." Mendeleev also predicted many of the properties of eka-silicon by comparing the properties of nearby elements on the periodic table.\(^5\)

In 1885 German chemist Clemens A. Winkler began an analysis of a newly discovered mineral called argyrodite obtained from a mine near Freiberg, Germany. Able to identify 94 percent of the elements in the mineral, Winkler could not account for the remaining 6 percent. After arduous experimentation he predicted that the unknown element must be Mendeleev’s eka-silicon. In February 1886 Winkler announced his discovery to the scientific community. He proposed the name “germanium” to honor his country, no doubt mindful that the element gallium had been named after France.\(^6\)

After his initial experimentation Winkler conducted additional tests and found Mendeleev’s predictions about the properties of germanium to be extraordinarily accurate. Yet after the initial excitement over the discovery, scientific interest in germanium faded rapidly. The scarcity of argyrodite and the lack of sophisticated instrumentation to detect germanium in other minerals impeded further research.\(^7\)

However, the development of the spectroscope and the spectrograph enabled scientists to detect elements with great precision. Germanium was found in minute quantities in a variety of ores and minerals. The highest concentration of germanium, averaging 4–8 percent, occurred in the mineral germanite. Germanite existed only at Tsumeb, Southwest Africa, and provided the major source of germanium. However, the expense of recovery precluded commercial applications since a pound sold for approximately $4.500.\(^8\)

Although present in much smaller quantities than in germanite, germanium was found in the sphalerite (ZnS) ore in the Tri-State during the early twentieth century. With no commercial market and concentrations of only 0.01 to 0.10 percent germanium, prohibitive recovery costs prevented practical research. Since the presence of germanium did not interfere with the mining and smelting of zinc, companies remained unwilling to fund research programs. The element “had almost been forgotten,” according to one Eagle-Picher scientist.\(^9\)

However, Eagle-Picher’s desire to produce electrolytic zinc during the late 1920s renewed interest in germanium. George Potter as-
signed Frank McCutcheon, manager of the Henryetta smelter, to head the electrolytic zinc project. To McCutcheon's amazement, Tri-State zinc ores would not electrolyze properly. Despite numerous attempts to refine the process, the result remained the same. Frustrated and anxious to identify the problem, he began extensive research into the properties of sphalerite ore.60

McCutcheon suspected that an impurity in the ore prevented electrolysis. Interested in rare metals recovery, he had worked on the separation of germanium, cadmium, gallium, and indium as chief chemist of the Bartlesville Zinc Company during the previous decade. Using his garage as a laboratory, McCutcheon had spent much of his spare time studying these elements. Now faced with a critical commercial problem, McCutcheon's interest soon turned to obsession as he diligently analyzed both the ore and the electrolytic process in search of a solution.61

After months of work McCutcheon found the answer. A small amount of germanium, no more than 0.001 percent of the ore, had caused electrolysis to fail. To produce electrolytic zinc, the ore had to be leached in sulfuric acid to form a zinc sulfate solution. Impurities in the ore, including germanium, dissolved into the solution and interfered with the electrolytic deposition of zinc. Identifying the problem, however, represented only one-half of the challenge.62

McCutcheon turned his energies toward the recovery of germanium, as well as other rare metals, as by-products of the electrolytic process. By purifying the zinc sulfate solution, McCutcheon created sludges containing germanium, indium, and gallium. He then developed techniques for separation and purification, eventually producing the first quantities of germanium from Tri-State ores. More important, McCutcheon had unlocked the secret of commercial production.63

Recovery of germanium as a principal product could never be cost effective due to the extremely small concentrations of the element and the scarcity of germaniferous ores. However, the recovery of germanium and other rare elements as by-products of other processes greatly reduced the cost of recovery and enabled researchers to produce sufficient quantities for study. With a process for crude recovery in place, the purification of germanium became the next challenge.

From his many hours of research into germanium recovery at Henryetta, McCutcheon had compiled extensive data and made obser-
vations of the element. Desiring to share his expertise, he developed close contacts with two Eagle-Picher research scientists at the Joplin laboratory: Harold R. Harner and John R. Musgrave. Harner and Musgrave shared McCutcheon’s interest in rare metals and exchanged information with him frequently. Harner had separated a small quantity of germanium dioxide from smelter residue in 1928 and had cultivated an interest in recovery and purification during the following years.  

Despite the accomplishments of McCutcheon, Harner, and Musgrave, the company had no official interest in germanium recovery until the late 1930s. The absence of commercial applications and the pressures of the depression prevented the company from funding a formal project. However, each of these men continued his private interest in germanium. In 1938 Harner convinced corporate research director Earle W. McMullen to allow limited funding for research into germanium recovery and purification from smelter residues. Harner contacted McCutcheon and began to lay the foundation for an official germanium recovery project. Relying on McCutcheon’s extensive experience in rare metals recovery, Eagle-Picher made rapid progress toward commercial production of relatively pure germanium.

After several years of experimentation and failure, in 1941 the research department completed the world’s first pilot plant for commercial germanium separation and purification. Working at the Henryetta smelter, McCutcheon and his assistant, C. C. Habeger, supervised the separation of germanium from smelter residues. The crude germanium was then brought to Joplin for purification. Harner’s team, including Musgrave, Leo DeClue, E. G. Hollman, and John Sommerville, built the purification unit and refined the process until the plant produced the desired quantities of germanium.

Although the pilot plant was an impressive achievement, the company still had no market for the product. Management retained its faith in the project, however, and continued to fund the pilot plant. As Musgrave observed, "this was true research—you learn how to do something and hope the knowledge will prove valuable at the proper time. It usually does." The company could not overlook the dramatic price reductions achieved by the pilot plant. Germanium could now be produced for approximately $225 per pound, compared with $4,500 per pound when the project began.

Concurrent with the development of Eagle-Picher’s commercial
germanium operation, the NDRC sponsored research into the fundamental properties of germanium at the Massachusetts Institute of Technology. The NDRC also sponsored a similar investigation of silicon at the University of Pennsylvania. These elements seemed to offer the greatest potential primarily because both were elemental semiconductors. Since purification was the key to a reliable semiconductor, scientists had to purify only one element, either germanium or silicon, and remove every other element from the sample. Although difficult, this type of semiconductor preparation was far easier than any other method. The physical integrity of both germanium and silicon also provided additional advantages over other semiconducting elements. Silicon was more robust, yet it proved harder to purify. Germanium became the favored material because it could be purified far more easily and offered many of the same operating characteristics as silicon.68

The declaration of war on Germany and Japan brought a new urgency to the semiconductor program. The NDRC advertised for a reliable supplier of germanium to support increased research efforts. Eagle-Picher responded with a letter informing the NDRC that the company could provide germanium immediately.69 With a source secured, the NDRC coordinated an extensive research program for the development of germanium and silicon semiconductors.

Wartime semiconductor research occurred within a matrix of government agencies, private industry, and academia. Perfecting the crystal rectifier, a key component in radar systems, became the focus for the research. While Eagle-Picher developed germanium production, Dr. Karl Lark-Horovitz and his team of physicists at Purdue University made an impressive series of practical discoveries during their government-funded germanium research program. By investigating purification techniques, the Purdue team developed germanium ingots suitable for the fabrication of crystal rectifiers. Lark-Horovitz also conducted research into the electrical properties of germanium and made the first definitive statements about the potential of germanium as a semiconductor. Coupling practical and fundamental research, the Purdue scientists made possible the production of reliable germanium radar detectors.70 Furthermore, owing to the work at Purdue and Eagle-Picher, germanium became the only semiconducting material available for practical use until scientists solved the problems of silicon purification in the mid-1950s.
The first shipment of Eagle-Picher germanium from the pilot plant to the NDRC program in 1942 was 99.9 percent pure, in itself an impressive achievement. Yet government scientists quickly found that the germanium was not pure enough for reliable operation as a semiconductor. Returning to Eagle-Picher, NDRC representatives related the news to the research department. Immediately Harner and his team began an intensive program to produce germanium with a 99.99 percent purity. After months of work they succeeded. Again, however, the NDRC returned the same news and demanded an even greater purity. Under tremendous pressure the research department refined the recovery process to produce 99.999 percent pure germanium in 1944. Suitable for reliable operation in radar detectors, it was among the purest metals ever produced.71

In 1946 a pilot plant at Joplin began the production of ultrapure germanium in commercial quantities. The availability of this germanium sparked additional research, most notably at Bell Laboratories, and made possible the invention of the transistor in December 1947. By 1948 Eagle-Picher produced over one thousand pounds of germanium dioxide, the commercial form of the element. Most consumers, including Bell, purchased germanium dioxide and reduced it to metal in their own laboratories.72

The success of commercial production and the promise of an important new market for germanium in postwar solid-state electronics research soon became a key issue with Bowlby and other corporate officials. Many questions remained to be answered. Foremost, the company had to determine the economics of its germanium operations. Until an economic survey could be completed, pricing structure, unit costs, sales forecasts, and the potential profitability of large-scale germanium production remained uncertain.

Although the company had only begun to work out the details of marketing germanium commercially, expectations for success ran high. With a proprietary position in a growing market, few doubted that Eagle-Picher would reap handsome profits. Bowlby could not have asked for a better example of his goals for the company. Exactly the type of business that he had envisaged for Eagle-Picher, the germanium project combined research excellence and technological expertise to produce a high margin item.

Apart from its obvious commercial potential, germanium research left a valuable legacy within the company. For the first time in its
history, Eagle-Picher had participated in research on the frontiers of scientific inquiry. The pride and sense of accomplishment of those involved created a culture that encouraged excellence and innovation within the research department.

Furthermore, Eagle-Picher's germanium project established a technological base from which other promising projects developed. The company maintained an ongoing research program into high-purity semiconducting materials such as gallium and silicon. McCutcheon produced the world's first pound of gallium metal, and Harner and Musgrave perfected a process for the extraction and purification of the element in the late 1940s.\textsuperscript{73} The company also pioneered a process for the purification of silicon but later dropped out of the market due to heavy competition.

The development of semiconducting materials and the pathbreaking technological achievements that evolved from wartime research constituted a collaborative effort. No individual, institution, or corporation can claim responsibility for the dramatic scientific, economic, and social changes that resulted from the development of solid-state electronics. However, individual contributions must be recognized to bring about a better understanding of this dynamic process. Eagle-Picher's role was clearly significant, and it remained one of the most important accomplishments in company history.

**Postwar Strategy**

While company employees enthusiastically supported the war effort, Bowlby and his staff prepared for the challenges of business in the postwar world. Plans for the expansion of manufacturing crystallized and led to the creation of a development program to evaluate every facet of the company. Bowlby shared the general anticipation for a period of prosperity after the war. A variety of factors—pent-up demand for goods that people did without during the war, the enormous productive capacity of industry, and an accumulation of purchasing power—foretold a bright commercial future. For Eagle-Picher, Bowlby believed that although a decline in mining when the war ended might reduce total sales, manufacturing operations would produce at capacity.

Demand for battery oxides as a result of the resumption of auto-
mobile production and demand for zinc and lead paint pigments due to increased residential maintenance postponed by the war represented two high-growth markets. The company's insulation business also seemed extremely promising. Not only would industrial markets remain strong, but the inevitable expansion of the housing industry would present new opportunities. With no reconversion problems, Eagle-Picher stood in a relatively good position to capitalize on post-war prosperity.

However, before the company could expand, extend, and diversify according to the development program, Bowlby had to complete a series of financial and organizational adjustments. Accelerated amortization of the mining properties had provided an important initial step. Next came a determined effort to move away from inventory speculation.

During the 1930s, the company had implemented a "normal inventory" system, carrying metals at a fixed, below market price and employing a reserve fund for possible decline. However, this did not stop the tendency to carry speculative inventories. Bowlby's policy intended to keep inventories at minimum levels and maintain a substantial reserve fund in short-term government securities to offset market declines. In the midst of a price-controlled market, large inventories posed no problems. However, Bowlby realized that once the Office of Price Administration lifted controls after the war, the vulnerability to speculative loss would be dangerous.74

The new inventory policy promised a stabilization of the company's financial position, and, in turn, improved its credit. Eager to accumulate capital for expansion, in March 1943 the board approved the issue and private sale of $5 million fifteen-year sinking fund debentures. Bowlby did not have specific investments in mind for the entire amount. Instead, he intended to use the money as opportunities arose. Through tax deductions and investments in short-term government securities, the effective cost of the issue was a mere 1.5 percent per year.75 The company listed its stock on the New York Stock Exchange for the first time in 1943. In May 1937 the board had initiated the process of listing the stock on the exchange. By September 1943, the company had completed an extensive report on its operations required by the exchange, and on 31 October exchange officials authorized the listing of 900,000 shares of common stock with a $10 par value. Although at first the stock was greeted with
intense scrutiny, investor concern faded with the march toward financial stability and the reorientation toward manufacturing.\textsuperscript{76}

With major changes under way, Bowlby and other top managers recognized that the business of the company had been, and now especially was, inconsistent with the name of the company. In January 1945 the board passed a resolution eliminating the word \textit{Lead} from the corporate name "in view of the position that the Corporation had won in fields other than the lead industries." Long overdue, the name change symbolized Bowlby’s overall design.\textsuperscript{77}

The years 1943–49 represented the beginning of a new era in the development of the company. The application of Bowlby’s plan for the expansion of manufacturing and the diversification of product lines served as a cornerstone for future growth. The fundamental shift in the outlook of the company enabled it to survive the decline of the Tri-State and capitalize on expanding postwar markets. Although only a first step, it eliminated the mining-manufacturing ambivalence and ushered in a new era for Eagle-Picher.

The preliminary financial alterations—amortization of the principal mining properties, reduction of inventories, and acquisition of low interest capital—provided a foundation for expansion. Coupled with the profits from wartime mining operations, these moves placed Bowlby in a position to seek new manufacturing opportunities. Surveying the company’s divisions, he intended to expand current product lines, extend processes toward the end consumer, and diversify by the acquisition of new businesses. Although he had no intention of abandoning high volume, low margin items immediately, Bowlby wished instead to balance them with new, higher margin products.

The “New” Company: Eagle-Picher’s Manufacturing Divisions

Within each of Eagle-Picher’s four manufacturing divisions, White Lead, Metallic Products, Pigments, and Insulation, Bowlby initiated changes based on the ideas of the development program. The divisions provide excellent case studies of the evolution of a new corporate direction and are illustrative of the company’s more aggressive posture.

The White Lead division produced the oldest continually manufactured product, basic carbonate white lead. The company sold most
of its white lead to the paint industry as a powder or mixed with linseed oil. Although white lead was used widely in the ceramics, rubber, and plastics industries, the company sold most of it to paint distributors. Carried at a loss through the war years, white lead represented a classic low-margin item. Several alternatives existed to improve the division’s performance. Production could be expanded to generate more volume and increase profits, new applications or forms of the product could be found, new geographical markets could be explored, or the division could consider manufacturing a line of consumer paints. In various forms, Bowlby pursued all these options.

However, despite energetic efforts, the decision to stay in the white lead business was flawed from the outset. White lead’s share of the paint market had been steadily declining since the late nineteenth century. Further, new products, particularly titanium dioxide, a pigment developed by National Lead in the early 1920s that possessed greater hiding power than any other white pigment, threatened to eliminate the use of white lead by anyone other than a small number of loyal master painters.

In 1941 Robert Heller and Associates had surveyed the White Lead division to determine options for increased profitability. One suggestion immediately caught Bowlby’s eye. If the division could manufacture a ready-mixed white lead paint, designated ready-to-use or RTU, for the consumer market, greater profit margins could be obtained. After careful consideration of the possibility that RTU might bring the company into direct competition with many of the Pigment division’s industrial customers who manufactured similar lines of paint, the company introduced RTU in 1944. Although the product achieved limited initial success, the objections of Pigment division customers eventually forced the White Lead division to withdraw RTU.

Undaunted, Bowlby pursued acquisition and expansion to improve the division’s performance. In 1945 Eagle-Picher acquired a 40 percent interest in MacArthur Irwin, Limited, of Montreal, Canada, for approximately $200,000. MacArthur Irwin manufactured a variety of mixed paints, white lead, and dry colors and operated a large research laboratory. According to Bowlby, the stock purchase represented “another step forward in the post-war expansion program of Eagle-Picher.” In addition to opening foreign markets for the
company's paint products, the investment also provided markets for the Pigment division's battery oxides since MacArthur Irwin had recently acquired the Hart Battery Company. Next, Bowlby purchased the International Smelting and Refining Company's plant in East Chicago, Indiana, in 1946. This acquisition expanded the White Lead division's productive capacity and also served the Pigment division. Situated on thirty-seven acres, the plant included an administration building, a laboratory, a mess hall, and storage tracks for ninety-two railroad cars. Bowlby commented that the plant's "strategic geographic location will help us render greater and faster service to the many diverse industries represented by our customers." Following the acquisition of the plant, Bowlby moved the headquarters of the White Lead division, formerly located in Cincinnati, to East Chicago. The company sold the plant on Broadway and Reading roads, built by John B. Swift in 1891, to the Churngold Company, a food processor. Only the central offices and a metallic product plant remained in Cincinnati.

Despite the failure of RTU, Bowlby remained interested in consumer markets. In 1948 he purchased the Alston-Lucas Company, a manufacturer of interior and exterior paints, enamels, and varnishes. He intended to market these products under the Eagle-Picher brand. After completing the acquisition, Bowlby dissolved Alston-Lucas and transferred its assets, along with the operations of the White Lead division, to a newly created Paint and Varnish division. The renaming symbolized the changes in the focus of the division and illustrated the company's desire to enter more profitable end-consumer markets.

The Metallic Products division presented the greatest challenge to Bowlby's development program. Increased volume seemed to be the only viable option to increase earnings on a host of marginally profitable items. The division manufactured such products as antimonial lead, bearing metals, caulking lead, lead pipe, tubing, wire, plumbers' lead fittings, solders, and tin-lead alloy metals. It sold approximately one-third of its products to the plumbing trade, one-third to storage battery manufacturers, and one-third to various other industries. During the war, price ceilings, restrictions on housing construction, and stiff competition from National Lead and American Smelting and Refining had caused losses for the division. For a time, Bowlby considered abandoning the metallic product business, but
when he could not arrange an advantageous liquidation plan, he decided to expand the business.\textsuperscript{85}

In 1945, Bowlby executed the first steps of his plan to increase the division’s presence in the market. The company purchased a secondary lead smelter and fabricating plant in Dallas, Texas. Producing antimonial lead and other metal products, the plant recorded over $2 million in sales within the first six months of its purchase. Other division acquisitions such as the Kansas City Smelting and Refining Company, the Cleveland Lead Works, and the production and distribution facilities of the Southern Lead Company increased production capacity and gave additional access to strategic regional markets.\textsuperscript{86}

Impressive production figures resulted from the aggressive expansion program. Tonnages of combined products increased approximately 400 percent over prewar levels and the division recorded a profit.\textsuperscript{87} The turnaround breathed new life into a dying business. However, these measures served only as temporary solutions to the fundamental problem of low margins in the metallic goods market. Increased volume generated short-term profits, but it became increasingly apparent that this type of business did not fit into Eagle-Picher’s long-term plans.

The Pigment division, accounting for approximately 10 percent of the company’s total sales, was Eagle-Picher’s largest manufacturing section. Essentially a chemical engineering division, its main products included litharge, red lead, lead silicate, sublimed white lead, sublimed blue lead, leaded zinc, lead-free zinc oxide, and lithopone. The division sold 41 percent of its products to the paint and varnish industry and 31.8 percent to the storage battery industry. Sales to the ceramics, rubber, insecticide, and oil refining industries made up the balance of the division’s business.\textsuperscript{88}

The expansion program for the Pigment division included both increased capacity and the extension of processes to produce higher margin items. During the war the division either broke even or recorded modest profits due to price controls. After the war profits increased dramatically when controls ended and demand for its products rose quickly. The purchase of the East Chicago plant signaled the first phase of expansion. Division operations at the new plant included the manufacture of two new products that illustrated the step-forward policy of the development program.\textsuperscript{89}

Previously, the division had produced marginally profitable red
lead, selling it to manufacturers of peroxide. Under the new policy, this process was extended and the division produced an excellent grade of peroxide, which it marketed effectively through its outstanding sales staff. During the first year of production, the division negotiated a lucrative contract with General Electric to supply substantial amounts of peroxide. Furthermore, a new process for refining zinc oxides resulted in the production of pharmaceutical zinc oxide, a highly profitable item with an increasing postwar market.\textsuperscript{90}

Division management also devised a new system of distributing raw materials to maximize their usefulness. Previously, the Mining and Smelting Company had sold most of its zinc concentrates for galvanizing. Under the new system it supplied zinc concentrates to the Pigment division for the production of higher margin zinc pigments. This also made the Hillsboro zinc oxide plant more cost effective since it reduced the plant's supply costs. Noting the success of the system, Bowlby adopted a general policy of routing more slab zinc and pig lead to company facilities that produced finished products.\textsuperscript{91}

The Pigment division also benefited from the budding germanium and specialty battery business. Although neither operation generated significant profits until the 1950s, both held great promise for the division. With a broad technological base and expanded production facilities, the Pigment division became the flagship division of Eagle-Picher in the postwar period.

While other divisions had suffered under wartime price controls and decreased demand, the Insulation division prospered with the highest profit margins in the company. Producers of a variety of home and industrial insulation products such as mineral wool and insulating cements, the division had experienced tremendous growth as total volume quadrupled between 1935 and 1940, and doubled again from 1940 to 1946 despite heavy competition from the Johns-Manville Company and the Baldwin Hill Company. The increasing demand for insulation, propelled by the postwar construction boom and by the frenzy to repair maintenance-starved buildings, assured a bright future for the division.\textsuperscript{92}

Bowlby increased the manufacturing capability of the Insulation division during the war by expanding the original Joplin plant and purchasing an additional plant at Wabash, Indiana, in late 1942 from the Union Rock Wool Company.\textsuperscript{93} However, the largest acquisition came in 1946, when Eagle-Picher purchased all the outstanding
shares of the Orange Screen Company of New Jersey, a manufacturer of high-quality combination storm windows and screens at two plants in Dover and Maplewood, New Jersey. In the pursuit of the home insulation business, which Eagle-Picher conducted through franchise dealers, company salesmen became aware of the demand for related products such as storm windows, screens, and attic fans. Bowlby capitalized on this demand with the $2 million acquisition and integrated Orange Screen’s operations into the Insulation division.94

The most significant event for the Insulation division in the immediate postwar period was the purchase of diatomaceous earth deposits and a processing plant at Clark, Nevada, in 1946 from the Nevada Celatom Company.95 Closely related to the development of new insulation products, the acquisition provided an excellent opportunity to explore profitable new markets. Diatomaceous earth, a mineral deposit composed of the fossilized shells of diatoms, could be used as a high-temperature insulant, a filter, an abrasive, and an absorbent.

A curious and useful mineral, diatomaceous earth deposits resulted from geologic phenomena occurring approximately 20 million years ago in the late Miocene and early Pliocene ages. Intense volcanic activity furnished the world’s waters with a high concentration of silica. Billions of microscopic, single-celled marine plants known as diatoms extracted silica from the waters and secreted it to form minute siliceous skeletons with intricate symmetrical designs. Diatoms varied in size from ten to one hundred microns. When diatoms died, their silicified remains sank to the bottom of ancient seas and formed sedimentary deposits. Through geologic epochs the deposits grew deeper and eventually became exposed as the waters receded. Diatomaceous earth, also called diatomite, appeared as a lightweight, chalkish mineral at many locations around the world. Diatomite deposits formed in fresh water as well as salt water, and both varieties possessed commercial value.96

The discovery of extensive diatomaceous earth deposits at Lompoc, California, in the 1890s led to an expansion of the diatomite industry in the United States. Insulating brick cut directly from the deposits became the first commercially successful product from the Lompoc fields. In 1912 the owners of the deposits, Kieselguhr Corporation of America, began a program to develop diatomite as a filter
aid under the trademark Celite. War production increased interest in diatomaceous earth because it proved an excellent filtering media for armies in the field. Kieselguhr became the Celite Company and in 1928 sold its deposits and processing plant to the Johns-Manville Company. In subsequent years Johns-Manville continued the development of filter-quality diatomite as well as diatomite insulation products. Extremely successful in its efforts, the company dominated the industry until the 1950s.\textsuperscript{97}

The diatomaceous earth industry grew steadily during the 1930s and 1940s. Average annual production increased from approximately 82,000 tons in the early 1930s to over 240,000 tons by the late 1940s. The average price per ton increased from $15 to $26 during the same period. As the industry grew, producers found additional applications for the unique mineral.\textsuperscript{98}

During World War II Nevada Celatom had developed a product as a substitute for peat moss called "vadazorb," which it marketed as a poultry litter. Disinterested in this product, Eagle-Picher liquidated the remaining stock. The company instead intended to develop diatomaceous earth products for industrial applications. The dream was to market diatomite as a filter aid for use in the chemical, brewing, and pharmaceutical industries since this end of the business offered the greatest profit potential. However, the diatomite deposits acquired with the Clark plant were not considered filter quality. For now, the company remained content to start slowly, developing the necessary processing technology to enter the filter-aid business and searching for filter-quality diatomite deposits.\textsuperscript{99}

The company's interest in diatomaceous earth had developed during World War II when the Insulation division used diatomite as a filler in a number of its products. After the war the research department studied the mineral's potential and concluded that it would be a good business for the company. Following the research department's lead because it had rarely been wrong, Eagle-Picher began to develop a technical base. The company hired two experts from other firms in the industry and organized a research group in Joplin to develop products. After the company had purchased the Clark facility, the research group set up a laboratory at the plant.\textsuperscript{100}

The first significant product developed at Clark was Floor Dry, an industrial absorbent made from specially processed powdered diatomite. Marketed in 1948, Floor Dry quickly became popular and
profitable. The company chose Celatom as the trade name for its line of diatomaceous earth products. Eagle-Picher promoted Celatom as a mineral filler for products such as asphalts, rubber, paints, polishes, explosives, plastics, and insecticides. Moreover, Celatom was sold as a mild abrasive for use in soaps, metal polishes, and dental powder and as an agent to create friction on match heads.101

The Clark operation represented the company’s attempt to round out its growing line of insulation products and building materials. With many applications, diatomaceous earth promised to open new markets in a variety of industries. Bowlby held great expectations for the continued growth of the Insulation division. From a humble beginning during the depression, the division had evolved into a highly profitable business reflective of Bowlby’s long-term goals for Eagle-Picher.

**Bowlby’s Legacy**

By 1948, the fruits of Bowlby’s development program became apparent. Eagle-Picher would never again be considered a mining company. The pursuit of a new corporate direction had given the company a framework for survival amid the decline of mining operations. Yet problems persisted. The company remained in low-margin businesses such as metallic products and white lead that showed little or no potential for growth. Lead and zinc mining represented a significant portion of earnings, and the metal markets still influenced the company’s financial position from year to year. Furthermore, while the trend toward manufacturing had been established, Eagle-Picher seemed unwilling to set specific goals.

Owing to an illness in his family, Bowlby chose to resign as president of the company in December 1948. The board elected T. Spencer Shore, a partner in the New York investment house Goldman Sachs and an Eagle-Picher director since 1943, to the presidency. Bowlby remained active in the company as chairman of the board until his retirement in 1955.

Bowlby’s presidency stands as a watershed in company history. His aggressive leadership during a time of upheaval, his vision for Eagle-Picher, and his skill in applying his plans provided a stark contrast to the pattern of management in previous years. He awakened a
lethargic, century-old company and initiated an essential transformation. The responsibility for continuing the regeneration of Eagle-Picher fell to Shore after 1 January 1949. Building upon the foundation of the Bowlby era, Shore further defined the direction of the company under his own aggressive expansion and diversification program. Bowlby had liberated the company. Shore would lead it into the modern era.